A COMPARATIVE EVALUATION OF A COMPUTER-SEQUENCED CURRICULUM AND A TRADITIONALLY-SEQUENCED CURRICULUM

By

THOMAS ROBERT RENCKLY

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There are three to whom I have devoted my greatest love and respect. It is to these three I wish to dedicate this work. First, to my Lord Jesus Christ who helped me in countless ways to achieve this pinnacle, and who, I believe, will continue to direct my life in His service.

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KEY TO ABBREVIATIONS

The following abbreviations are used in several Tables and Appendicies:

CNRC - Commander, Navy Recruiting Command. The Washington D.C. Headquarters Staff of the US Navy Recruiting Command.

NORU - Navy Recruiting Orientation Unit. The Navy Recruiting Command's training facility located in Orlando, Florida.

ENRO - Enlisted Navy Recruiting Orientation. One of several courses offered at NORU designed to train US Navy personnel in the skills necessary to recruit young men and women into the US Naval Service.

ASVAB - Armed Services Vocational Aptitude Battery. An entrance examination used by the Armed Services to provide information regarding an applicant's aptitudes for various military vocations. The examination is composed of several subtests ranging from tests of verbal ability, work knowledge, mathematical ability and arithmetic reasoning ability to mechanical ability and spacial perception. Scores from the various subtests of the ASVAB are used to determine one or more military vocations for which an applicant appears to possess the requisite abilities.

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This study represents the collective observations of 550 subjects in the Navy's Enlisted Recruiter Orientation Course over a one and one-half year period. Its purpose was to determine the effectiveness of a spiral-sequenced (revised) version of the course against a linear-sequenced (traditional) version. The spiral course sequence was developed with the aid of a computer program, developed by the investigator, which is based on a methodology known as Interpretive Structural Modeling (ISM).

The study attempted to compare the revised and traditional courses in terms of their resulting academic attrition rates and perceptions of course graduates concerning the fidelity of training received in each course to real-world recruiting practices. The revised course was further evaluated on its ability to reduce within-course failures, and on the level of instructor acceptance of the computer-designed course sequence.

Findings revealed that, first, absolute academic attrition rates in the revised course were larger than those for the traditional course. However, the revised course demonstrated a steadily declining trend in academic attritions over the duration of the evaluation. Second, graduates' perceptions of the fidelity of training received in the revised course showed less variability in ratings of training adequacy than did those from graduates of the traditional course. Third, the revised course demonstrated a dramatic reduction in the percentage of within-course failures over the evaluation period. Finally, instructor acceptance of the computer-designed course sequence demonstrated a marked increase across several evaluation cycles.

The findings of the study led the investigator to conclude that the revised course sequence was at least as effective as the traditional course sequence in reducing academic attrition rates and within-course failure rates. Furthermore, the revised course was concluded to be superior to the traditional course in its fidelity to real-world recruiting practices according to graduates' perception ratings.

CHAPTER I

INTRODUCTION

The United States Navy Recruiting Command's training organization has expressed concern over three aspects of its Enlisted Recruiter Canvasser course: academic attrition, within-course failures and course graduates' perceptions of the applicability of school training to real-world recruiting practices. In addressing these concerns, the organization's administration suggested that the course be revised in an attempt to improve the state of the course in terms of these three aspects. In a preliminary review of the literature on curriculum revision, the investigator discovered that sequencing of instruction is among the most critical segments in the instructional design process. Bloom (1976), for example, substantiated its importance in a separate review of research, wherein he suggested that instructional sequencing accounts for fifty percent of the regressed variance in school achievement. The concept of sequence referred to in Bloom's review is similar to that referred to by Gagne (1962, 1968, 1977) in a classic series of investigations through which he developed the notion of the learning hierarchy.

An important aspect of instructional sequencing addresses the overall organization of topical elements within a total curriculum. Here we may differentiate between instructional sequencing on a macrocosmic scale (i.e. inter-topical), and sequencing on a microcosmic scale (i.e. intra-topical). Gagne's methodology falls into the latter category. Indeed, Briggs and Wager (1981), considered Gagne's intellectual skills hierarchies as components of more global instructional curriculum maps which "can contain intellectual skills objectives and their principle prerequisites as well as objectives from other domains . . ." (p. 91)

On a macrocosmic scale, curriculum sequences are classifiable into two generic groups: block-sequenced and spiral-sequenced. A block-sequenced curriculum may be defined as one in which topics are presented separately as intact entities. For example, topic A is presented in toto, then topic B is presented, etc. No attempt is made to relate concepts of topic A to those of topic B. Such a sequencing strategy would be used when a curriculum is composed of highly unrelated topics. The investigator knows of no examples of curricula which are purely block-sequenced.

A spiral-sequenced curriculum, described by Bruner (1960), is described as one in which fundamental concepts are presented early in the curriculum, and are built upon and related to more advanced concepts as the curriculum progresses. Apparently, curricula containing highly interrelated topical content would be amenable to a pure spiral-sequenced strategy.

The investigator discovered that, in practice, few if any contemporary curricula exhibit purely one or the other generic sequencing strategy. Most curricula are sufficiently complex to contain elements of both strategies. The U.S. Navy Recruiting Command's training course for Enlisted Recruiters is an example of a complex curriculum amenable to a combination of both sequencing strategies. Yet, in the past, the amount of sprial sequencing used in the course was minimal. Based on Bloom's (1976) review of research regarding the importance of sequence in instruction, and Bruner's (1960) writings on spiraling, the investigator proposed a revision to the course in which a learning hierarchy would be developed for the course, and from that, a more heavily spiraled course sequence would be generated and implemented.

Problem Statement

Would the implementation of a primarily spiral-sequenced structure for the course result in lower student attrition and roll-back rates and a greater perception, in the minds of the course graduates, of the applicability of school training to real-world recruiting practices than that observed in a predominantly block-sequenced course structure?

Objective

The purpose of this study was to ascertain the effectiveness of a computer-generated, spiraled curriculum sequence for a course of instruction in Navy Enlisted Recruiting practices (the revised course) against a previous version of the same course sequenced in a linear, or block, manner (the traditional course).

Study Questions

1. Is there a difference in academic attrition rates between the traditional and revised courses?
2. Is there evidence of either stability or consistent decline in academic attrition rates across several independent observations of the revised course?
3. How do graduates' perceptions of the applicability of training to real-world recruiting requirements differ in the traditional course compared to those in the revised course?
4. Is there evidence of a change in the level of procedural fidelity regarding classroom instruction in the revised course over the duration of the study?
5. Is there a difference in academic roll-back rates across several independent observations of the revised course?

Justification For the Study Questions

The three areas of concern expressed by the school's administration were: 1) the rate of academic attrition from the course, 2) the rate of within-course academic failures and 3) course graduates' perceptions regarding the applicability of training to real-world recruiting practices. The first study question was directly related to the first area of concern.

Nearly every instructional innovation may be influenced to some degree by either the Hawthorne Effect, wherein the experimental group's results are inflated due to knowledge that they are part of the experiment, or the John Henry Effect, where a control group produces inflated results out of a psychological need to prove itself better than the experimental group (cf. Anderson, et al.; 1975). Conscious of this potential effect, the investigator developed a research design which incorporated three independent observations of the revised curriculum over a time span of one and one-half years. The second study question was formulated to identify trends in the academic attrition rate in the revised course throughout this time span. Either a stable or decreasing trend in the revised course's attrition rate was acceptable as evidence of improvement brought about by the revised course sequence.

Regarding the third study question, ultimate acceptance of the revised course by the school's administration was based largely on the course's ability to promote positive transfer of training from the school environment to the real world of recruiting. One measure of whether such transfer actually took place was assumed to rest with the perceptions of the course graduates.

In attempting to measure differences with respect to two sequences of instructional presentation, it is necessary to insure that the intended instructional sequence is actually being followed at the classroom level. Reluctance of the instructional staff to follow the revised sequence may result in little more than perpetuation of the traditional sequence. If such an event were to occur, an identified difference in any of the curriculum aspects studied could not necessarily be attributed to the revised sequence. It, therefore, became necessary to monitor the instructional process in terms of presentational sequence. The fourth study question provided for the gathering of data regarding how well the revised sequence was followed by the instructional staff.

The fifth study question, dealing with within-course academic failures (roll backs), represented another of the aspects of interest to the school's administration. Since the Enlisted

Recruiter Course is competency-based and criterion referenced, it can be argued that academic achievement scores from course examinations would show little if any change between the traditional and revised courses. The argument follows from the fact that in this competency-based course, students must demonstrate mastery of at least 75% of the course objectives to be considered competent in the theory of recruiting. Since this competency-based philosophy remained essentially the same in both the traditional and the revised courses, it was reasonable to expect that mean achievement scores across the two courses would be essentially stable, within the limits of measurement error. A more meaningful measure, however, was the ratio of students who were rolled back one or more weeks of the course, but did eventually graduate. The investigator suspected that such a measure would relate more closely to the type of sequence used in the course than would academic achievement.

Assumptions and Limitations

One of the assumptions in this study related to the disagreement between Cronbach and Scriven (Cronbach, 1963; pp. 672-83) concerning the purpose of educational evaluation. Scriven believes it appropriate to compare different educational programs and to determine which one is best. Cronbach, on the other hand, posits that educational programs are sufficiently diverse in terms of their goals, content, target populations, etc. as to be virtually incomparable in any but the most general sense. To Cronbach, the purpose of educational evaluation is to answer the question: How can a particular program be made better? The author agrees with this latter position. Comparisons and generalizations between this particular course and some other which teaches different topical material are beyond the limits of the design controls imposed on this study.

A second assumption involved the question of how faithfully the instructional sequence was implemented in both the revised and traditional courses (instructional procedural fidelity). Because records of classroom observations did not exist for the traditional course, the two course sequences could not be compared on this dimension. However, it was determined from historical documents that the traditional course had been taught essentially the same way for nearly two years prior to the implementation of the revised course. The investigator assumed this length of time to be sufficient for the instructional staff to stabilize implementation procedures in the traditional sequence. Furthermore, because data on attrition rates, roll-back rates and graduates' perceptions for the traditional course, were gathered during the last three months the course was in operation, the investigator felt secure in assuming that the implementation of the traditional sequence was stable. Nevertheless, because no evidence existed to support the validity of this assumption, the study was limited to the extent that no comparison between the traditional and revised course sequences could be investigated on this dimension.

A third assumption involved the validity of data gathered from student surveys and administrative records. It was assumed that data provided from these sources were unbiased and truthful.

Definition of Terms

Academic Attrition Rate - The ratio of the number of subjects disenrolled from the course for academic reasons to the total number of subjects initially enrolled in each evaluation cycle.

Academic Roll-back Rate - The ratio of the number of subjects who failed a week of instruction for academic reasons and were required to repeat the week to the total number of subjects initially enrolled in each evaluation cycle.

Graduates' Perceptions of Course Adequacy - A subjective rating elicited from course graduates after they had had time to acquire some experience in the field. Their perceptions were derived from responses to a post-graduate survey composed of questions relating to topics presented in the course.

Instructional Procedural Fidelity - The degree of similarity between the intended course sequence as published in course schedules and the actual sequence implemented in the classroom as determined through unobtrusive measures.

Revised Course - An instructional sequence for the presentation of recruiting concepts (e.g. sales techniques, prospecting methods, etc.) based upon expert judgement concerning the interrelationships among the concepts of the curriculum (inputs). The sequence was derived with the aid of a computer program which manipulated the inputs, made logical inferences based on the interrelationships provided and developed a hierarchical structure for the curriculum from those inferences.

Traditional Course - An instructional sequence developed for the presentation of recruiting concepts (e.g. sales techniques, prospecting methods, etc.) based upon expert judgement concerning the interrelationships among the concepts of the curriculum. Operationally, this type of sequence is defined as one constructed manually according to the procedures described by Gagne (1977) or Briggs and Wager (1981).

Overview of the Dissertation

Chapter II contains an in-depth review of two topics. First, the historical development of instructional hierarchies is examined. Second, a review is presented of various attempts to apply rigorous methodologies to the design of curriculum sequences. Chapter III describes the design of the study. Chapter IV is devoted to an analysis of the evaluation data. Chapter V presents a summary of findings, conclusions and recommendations.

CHAPTER II

REVIEW OF THE LITERATURE

The Historical Development of Instructional Hierarchies

One distinction between the curriculum focus in this country prior to, during and following, the decade of the 1960s was in scope. During the time in which Tyler (1949) proposed his theory of curriculum design, the emphasis in curriculum was macroscopic, i.e. subject-centered. The primary question of interest at the time was: "What subject matter best suits the needs of the learners for the challenges they face today and in the future?" This focus was essentially the same as that of the early part of the century when Bobbitt (1924) and Charters (1923) first espoused it. In fact, the Eight Year Study, in which Tyler was key member, was predicated on the need for learners to be prepared for college, rather than vocational work.

An Atomistic View of Knowledge - The Spiraling Paradigm

By the beginning of the 1960's, it became apparent to researchers that a macroscopic view of learning could not provide answers to questions such as, "why do some learners learn more quickly than others?", and "is there a way to make learning more effective for all learners?" Educational psychologists, as well as curriculum makers, were looking for a means of perceiving instruction in a more atomistic fashion. The early work of Jerome Bruner and others provided a step in that direction. In his synopsis of the proceedings of the Woodshole Conference entitled The Process of Education, Bruner (1960) detailed a curriculum design concept known as "spiraling". The concept is based on the assumption that to learn effectively, a learner needs an initial mental framework in which to store basic concepts and facts which would later be internalized to form more complex concepts, rules and generalizations. Bruner clearly saw a spiral curriculum as possessing the ability to effectively teach complex concepts in an "intellectually honest" way to any individual.

Using the spiraling concept, one would present an underlying conceptual base first, and then rely on this conceptual base as a foundation upon which to build more elaborate combinations of facts and related concepts. One could, for example, teach a four-year old child the theory of thermodynamics. One simply calls it something other than thermodynamics. Indeed, it is the rare four-year old who does not intimately understand, from previous personal experience, the concepts of heat and cold, which are the fundamental concepts of thermodynamics. This is the sort of conceptual base Bruner referred to as necessary for learning more advanced principles.

However, the paradigm was shown to have limits. Results of attempts to apply Bruner's concept to actual instruction were mixed, although not experimentally verified. Apparently, some academic subjects were more amenable to spiral sequencing than others. So strong was the controversy surrounding the efficacy of the technique that Bruner later wrote that the major flaw in the concept was that it made tacit assumptions that students were pre-motivated to learn, and that all students had the benefit of existing analytic skills supposedly taught via some "middle-class hidden curriculum" (Bruner, 1971; p. 19).

Yet, the apparent limitations of the spiraling paradigm are reconcilable if considered in light of a holistic view of education. Bruner, for instance, believed that the structure of knowledge was discipline-dependent. For example, he viewed the structure of mathematics or the sciences as different from the structure of the humanities or the arts. In fact, Gagne (1962) believed that the fundamental difference between these particular disciplines was in the human faculties, or domains, affected most in learning them. Specifically, Gagne saw the structure of mathematics as composed of well-defined concepts, rules and principles which could be discretely quantified through the use of the intellect, whereas the structure of the arts was more closely linked to the affect and less to the intellect. Thus, Bruner delineated the boundaries of effectiveness of his spiraling concept to include those tasks and disciplines characterized primarily as intellectual. As will be seen, this delineation was a generalized formulation of a more specific notion espoused years earlier by Gagne.

Hierarchically Mapping the Structure of Knowledge

The concept of the learning hierarchy resulted from the research of Gagne (1962, 1968, 1977) and Gagne and Paradise (1961). In a classic paper, Gagne (1968) defined a learning hierarchy as ". . . a set of specified intellectual capabilities having . . . an ordered relationship to each other" (p. 2). He described the hierarchy as a construct which "represents the most probable expectation of greatest positive transfer [of knowledge]" (p. 3). This is exactly what Bruner (1960) believed his spiraling concept would elicit - a path providing the greatest positive transfer of knowledge. Like Bruner, Gagne (1968) "incautiously attempted to generalize the [concept] of learning hierarchies to such subject matter fields as the social sciences" (p. 4). He realized, however, that "in doing this, it is quite easy to fall into the trap of describing 'knowledge' entities rather than skill entities" (p. 4). This is the major departure in the thinking of Gagne and Bruner. Whereas Bruner (1960) defined the limits of his spiraling concept in holistic terms (e.g. intellectual versus affective), Gagne (1968) defined the limit of his learning hierarchy concept as one existing between knowledge and skills. This shift in the view of the structure of knowledge clearly defined the limits of use of such structuring concepts as the learning hierarchy.

According to Gagne (1968), his hierarchy concept, as applied to instructional presentation, is appropriate to those bodies of knowledge which inherently involve acquisition and application of learned skills. His favorite exemplar is mathematics, which involved both intellectual knowledge and skills. The difference, though, between this skill-based knowledge and the knowledge of the social sciences, according to Gagne, is that in mathematics not only is the skill dependent upon the acquisition of the knowledge, but the knowledge is discretely quantifiable. For example, knowledge of the processes of addition and subtraction is necessary to master these skills, as well as to understand the more complex processes of multiplication and division and the skills necessary to master them. Mathematics abounds with such interrelationships. There are fewer instances of similar interrelationships in the social sciences. This does not denigrate the knowledge of the social sciences, but merely distinguishes it from the skill-based knowledge of mathematics.

The previous example illustrates the complexity of the relationships among the elements of mathematics. Add to this complexity the need to consider the interrelationships between and among intellectual skills and verbal skills necessary for the student to explain (as opposed to perform) a mathematical skill, and it becomes apparent that the process of developing a learning hierarchy to represent a single skill, or an entire discipline of skills, is not simple.

The process proposed by Gagne (1968) for developing learning hierarchies consisted essentially of two stages. First, one identified the skill to be learned, and then determined its constituent components (or tasks) - both intellectual and verbal. Second, one attempted to determine precisely how the various tasks related to each other to make up the resultant skill. Gagne's method for determining task interrelationships was to begin with the final (terminal) task and ask the following question of it and each subsequent task in the list: "What would the individual already have to know how to do in order to learn this new capability simply by being given verbal instructions?" (p. 3). Once a hierarchy was constructed in this fashion, it was analyzed to determine if all interrelationships in the hierarchy were valid, or if errors existed. If inconsistencies were shown to exist in the hierarchy, the entire process was repeated in an iterative trial-and-error manner until a hierarchy was generated which displayed as few internal inconsistencies as possible. The technique tended to become time-consuming as the number of tasks to be ordered, hence the number of interrelationships between tasks, increased. Nevertheless, as a result of his research, Gagne was able to formulate an empirical sequence for the learning of intellectual skills (see Briggs and Wager, 1981; pp. 90-91). This sequence combined such subskills as discrimination, rule using, concept formation and problem solving in a structure similar to that shown in Figure 1. An illustration of Gagne's hierarchy development technique is provided in Appendix A.

Experimental Validation of Learning Hierarchies

Through the use of this questioning process, Gagne was able to hierarchically organize several intellectual skills in mathematics, including the basic arithmetic operations, grouping (or set theory), formula generation, etc. (Gagne, 1962; 1968). Furthermore, he validated his hierarchies through testing. His basic experimental approach was essentially the same in each experiment. First, a test was administered to the learner to identify which subordinate tasks he or she already knew how to do.

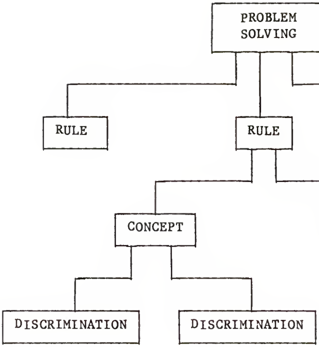


Figure 1. Gagne's Generalized Hierarchical Sequence for the Development of an Intellectual Skill

Next, the learner was taught to do those subordinate tasks which he or she could not initially perform. Then, after instruction, the learner was given verbal directions about doing the final (or terminal) task without any practice on it.

The results of Gagne's experiments indicated that students who learned all the subordinate tasks generally could also perform the terminal task without prior practice. On the other hand, those who lacked the ability to perform the subordinate tasks usually could not perform the terminal task either. Experiments such as these formed the basis for a belief in a true hierarchical ordering of subordinate tasks which built toward a final skill.

In the early days of Gagne's theory testing, few extant measurement techniques were capable of measuring the types of hierarchical ordering he was seeking. A technique used by Gagne was known as Guttman Scaling; this technique is based upon the premise that given a series of tests relating to a set of hierarchically ordered topics, say A, B, C and D as in Figure 2, a learner should not be able to pass test D until and unless he has passed all tests subordinate to it. Thus, a perfect Guttman score on the entire series of tests could be illustrated in matrix form as in Figure 3. In this matrix, a "1" indicates that passing the test identified by the row index is prerequisite to passing the test identified by the column index.

The application of Guttman scaling techniques to the Gagne experiments is straight-forward since the skill hierarchy is determined a priori. The validity of a Gagne-type hierarchy was

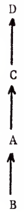


Figure 2. A Hierarchically Ordered Set of Tests

$$\begin{array}{c|cccc|} & B & A & C & D \\ \hline B & 1 & 1 & 1 & 1 \\ A & 0 & 1 & 1 & 1 \\ C & 0 & 0 & 1 & 1 \\ D & 0 & 0 & 0 & 1 \\ \hline \end{array}$$

Figure 3. A Perfect Guttman Matrix

the measure of how closely each learner's test score sequence approached the ideal indicated in Figure 3. Because Gagne's skill hierarchies were usually of a more complex nature than the simple linear relationship depicted in Figure 2, Gagne concluded that this scaling technique "did not seem entirely satisfactory . . ." (Gagne, 1968; p. 6). Part of the reason for this, alluded to by Bergan (personal communication), appears to derive from a limitation of scalogram analysis when applied to hierarchical ordering. This limitation can be better understood by the following illustration. Given two tests, one of which is truly prerequisite to the other, scalogram analysis will correctly deduce the order. However, assume that two tests (or concepts) are equivalent, such that one must be mastered prior to acquisition of the other, and that this prerequisite mastery exists in both directions between the two tests. In other words, the two tests are mutually supportive. According to Bergan, since scalogram analysis is sensitive to linear supporting relationships, the method becomes confounded in such an instance, and attempts to produce a *linear* hierarchical ordering. Despite this apparent limitation, Gagne discovered through his validation experiments that a significantly larger percentage of learners learned according to his hierarchically ordered path than those who did not.

Further Validation of Learning Hierarchies

After Gagne introduced the concept of the learning hierarchy and demonstrated its utility in the learning process, independent research ensued conducted principally by the Learning Research and Development Center at the University of Pittsburgh. Wang (1973), for example, attempted to validate hierarchical instructional sequences for an early learning curriculum. The curriculum consisted of fourteen hierarchically ordered major instructional units, while each unit was, itself, a hierarchically arranged fine-structure of instructional objectives (or tasks). In one of these experiments, Wang used a variation of Guttman scaling known as Multiple Scalogram Analysis (Lingoes, 1963) which essentially reorders the tests based upon resulting student pass/fail ratios to produce the most optimal ordering sequence possible. For her experiment, Wang used a hypothesized sequence developed in an earlier project (Wang, et al.; 1968). She assumed that the hypothesized sequence would be validated when it matched the empirical scale produced by multiple scalogram analysis, and would be rejected if it differed from the empirical scale. The findings of the study were mixed. The hypothesized sequence of the fourteen major curriculum units was directly confirmed. However, the fine-structure sequences of each of the units yielded results which were difficult to interpret. Based upon the results of this and other related studies (Resnick and Wang, 1969; Wang et al.; 1971), Resnick (1972) suggested that there may be an optimal "unit size" for hierarchical analysis.

The work of Bergan, Karp and Neumann (1979) expanded upon Wang's (1973) research in an attempt to determine if individual characteristics, coupled with mastery of hierarchically subordinate skills, influenced the acquisition of super-ordinate skills. They used a multiple regression procedure to determine correlations among various learner characteristics and subsequent learner performance on a set of hierarchically subordinate skills. These correlations were then ranked to form a hierarchically ordered arrangement of individual characteristics and skills making up the task to be learned. Their findings provided tentative support for the contention that "individual characteristics affect initial prerequisite-skill performance directly, and superordinate-skill learning indirectly through their impact on prerequisite skill learning" (Bergan et al., 1979; p. 252). These findings provided at least a tentative explanation for variations in learner performance.

Thus, according to Bergan, one explanation for the less than overwhelming success experienced by Gagne, Wang and other researchers who attempted to validate hierarchically ordered instructional sequences "could be attributed to other learned skills that are prerequisite to the skills under investigation, but that have not been explicitly identified and assessed" (Bergan et al., 1979; p. 253). Once again, there is evidence that the process of developing and testing learning hierarchies and instructional sequences is complicated by interacting factors.

Although, as indicated, there has been research in the area of hierarchical sequencing of instruction, it is scant and limited in scope. One reason for this paucity may be the difficulty of hypothesizing and constructing learning hierarchies. Glaser (1972) stated the problem quite succinctly when, in his review of experiments with hierarchical learning, he commented that he had "not seen suggested a set of rules by which a hierarchical analysis is rigorously and systematically performed other than perhaps two rules: (a) lay out a chain [of skills], and (b) ask the question originally asked by Gagne . . ." (p. 353).

Approaches to the Development of Instructional Hierarchies

Up until the time of the late 1970s, much of the methodology of instructional design had been fairly well proceduralized (cf. Gagne and Briggs, 1974), with the single exception of instructional hierarchy development. In fact, the extent to which formal procedure entered into this phase of the development process was described by such phrases as "common sense logical ordering" and development of a sequence "that an experienced designer would employ in practice" (Gagne and Briggs, 1974; pp. 139-140). The need for formal procedures useable by novice curriculum designers was evident.

Davies (1973, pp. 94-97) refined a formalized matrix analysis procedure for identifying speicfic structures involved in learning a skill. With his technique, a curriculum designer or teacher could analyze a skill to be learned to determine if it involved the learning of signals, chains, multiple discriminations, concepts or principles. The method required the construction of one or more matrices describing the interrelationships among various tasks making up the skill to be learned. The technique was time-consuming. Yet, it did enable the construction of teaching sequences via a more proceduralized methodology than had existed previously.

A Structural Approach to Hierarchy Development

A different approach to the problem of developing a procedural methodology for deriving learning hierarchies and instructional sequences, known as the Structural Strategies Model (Reigeluth et al., 1978), emerged in the late 1970s. This model consisted of four steps: (1) determine the type of structure which best represents the subject matter to be presented, (2) develop the structure by identifying an elementary set of principles, or a model upon which all other principles elaborate, (3) determine the supporting and prerequisite substructures of the tasks to be learned, and (4) sequence the elements of the structure and substructures.

To accomplish step one of this model, a curriculum designer must identify the specific type of subject matter structure. Three structures are described in the model. The first, an orientation structure, is an all-inclusive structure which subsumes most of the subject matter to be taught. Examples of orientation structures are taxonomies, hierarchies and models. The second type of structure is called a supporting structure. It provides knowledge that contributes to the understanding of an orientation structure. It may also be in the form of a taxonomy, hierarchy or model. Such structures may be combined in a particular instructional design, similar to the combination found in Wang's (1973) study wherein her "orientation structure" was the hierarchy of fourteen instructional units each containing a "supporting structure" of several hierarchically ordered objectives.

A learning prerequisite structure is the third type described in the model, and is the most loosely defined. It is described as containing any relevant information presupposed by any other structure. This structure relates most closely to the prerequisite skills brought by the student into a course (cf. Bergan et al.; 1979).

To complete the second and third steps of the model, the designer must be familiar with these three different structures, and knowledgeable of the curriculum's subject matter content. The fourth and final step in the model involves the actual sequencing of the instructional content.

An analysis of the procedures embodied in the model reveals that rigor is involved in the "front-end analysis" of the subject matter (steps 1, 2 and 3 above). However, the procedure detailed in the model for developing the instructional hierarchy and sequence is essentially the same as the process espoused by Gagne and Briggs (1974).

Viewing Curriculum as a Complex System

Another methodology for developing learning hierarchies and instructional sequences is one based upon a theory of complex-system analysis known as Interpretive Structural Modeling (Warfield, 1976). The premise behind this theory is that any complex system of interacting elements is capable of being decomposed into a constituent hierarchical structure which completely describes the interrelationships existing in the system. The theory's application to education in general, and instructional design in specific, becomes apparent when one recognizes the actual complexity of the educational process. As Warfield (1976) observes,

> education involves not only buildings, teachers and curriculum, but also home life, ethnic attitudes, motivation to learn, economic effects exemplified by the 'taxpayer revolt,' effects of the power structure, political implications, applicable legislation, discrimination and

> more. A study of education that fails to give proper consideration to these factors may be no more than partially sucessful, at best. . . . Failure to recognize potential interactions often precludes action that could be very beneficial, and allows many good opportunities to be missed. (p. 5)

Of course, there is no startling revelation here. Warfield's observation is, in fact, generic to any real-world complex system. However, the relevance of education's complexities to the instructional design problem becomes important when one realizes that, up to this point in our review of rigorous methodologies, we have not seen a model which has the capability of addressing such factors in any way except post hoc. Interpretive Structural Modeling (ISM) appears to possess a mechanism capable of not only considering, but also sorting out the interacting effects of limiting constraints while the complex system is being resolved into its constituent components, not after the fact. By way of the methodology, one is able to develop hierarchical maps describing the interrelationships among the elements of the system.

As noted, a curriculum can be viewed as a complex system of interacting elements. Some of the elements would, of course, be the objectives (or skills) to be learned. Other elements would be the facilities, budgetary, logistic and staff considerations which always interact with the ultimate curriculum sequence, but which are seldom, if ever, considered in developing instructional hierarchies or sequences; and not at all alluded to in the literature reviewed up to this point. An application of the ISM methodology is provided in Appendix B.

Sato (1979) was the first to publish an application of ISM to the specific development of instructional hierarchies. Two years later, Renckly (1981) reported an independent effort to apply ISM to both the development of instructional hierarchies and the generation of instructional sequences. Though developed independently, the approaches are similar. One of the differences between them is that Sato's approach employed a main-frame computer, whereas Renckly's approach was to utilize a microprocessor. Another difference was the lack of an explicitly stated procedure in Sato's work, while Renckly (1981) illustrated an explicit five-step procedure for implementing the ISM approach to aid in developing instructional hierarchies and presentation sequences:

> 1. Identify objectives of the curriculum.
> 2. Determine a transitive relation that applies to the objectives in the context of the instructional situation.
> 3. Place the objective relationships into a matrix format . . .
> 4. Manipulate the matrix into a suitable form - called a reachability matrix.
> 5. Re-order the rows and columns of the reachability matrix and partition it to reflect hierarchical levels . . . (p. 203)

In following this process, it is assumed that the instructional objectives are developed a priori. This activity is well-developed and highly proceduralized (cf. Gagne, 1977; Briggs and Wager, 1981). However, the five-step process above, though relatively simple in appearance, describes a method for deriving instructional hierarchies which had been deficient in the literature up until its publication. Rather than relying on a purely manual process for determining an ordered hierarchical display for a set of instructional objectives, ISM presents the designer with questions regarding the existence or non-existence of relationships between each pair of objectives under consideration, and utilizes iterative algorithms to manipulate the information obtained from the designers into a hierarchical form. The procedural structure offered by the ISM methodology may, indeed, possess the potential to transform the task of instructional design into a more "scientific art."

In summary, the tasks of instructional hierarchy building and sequence generation have traditionally stressed an essentially quasi-proceduralized, trial-and-error development process. Using such a methodology, researchers have made significant discoveries regarding the hierarchical ordering of learning tasks, which may be integrated into some future theory of learning. However, it has been surmised that the paucity of research into hierarchical learning processes may be due, in part, to the lack of a proceduralized, easy-to-use methodology for developing such hierarchies.

We have seen two rigorous methodologies for constructing hierarchies. Although substantially different in approach, their purposes are similar - to aid in the construction of instructional hierarchies and presentation sequences to make learning more effective. Of these two methods, Structural Strategies and Interpretive Structural Modeling, the latter appears to possess the ability to address instructional constraints via the same procedural mechanism used to address relationships between and among the instructional objectives.

CHAPTER III

DESIGN

Evaluation Methodology

This study was a three-phase summative evaluation of the U.S. Navy's Enlisted Recruiter Course - a course designed to train sailors the skills necessary to recruit young men and women into Naval service. The evaluation methodology used for this study was based on a strategy developed by Robert E. Stake (1967) known as the Countenance Model (see Figure 4). Essentially, the methodology identifies the ANTECEDENTS (those things which are required of students, staff and the instructional program prior to actuating the curriculum), the TRANSACTIONS (the precise instructional procedures carried out during the course which affect student learning) and the OUTCOMES (or products) of the course of instruction.

These three dimensions (Antecedents, Transactions, Outcomes) are each applied to four general areas of concern: the theoretical INTENTS of the course, the OBSERVATIONS of what actually occurs throughout the course, pre-established STANDARDS, and JUDGEMENTS based upon the degree to which those STANDARDS are met. As Stake (1967, p. 536) described it, "Judging is assigning a weight, an importance to each set of standards. Rational judgement in educational evaluation is a decision as to how much attention to pay to the standards ... in deciding whether or not

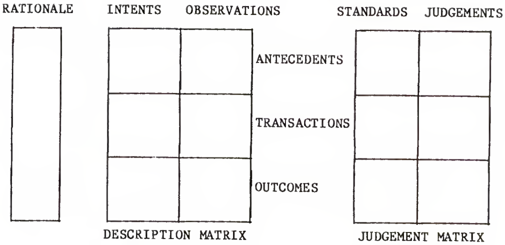


Figure 4. The Countenance Model of Evaluation

to take some administrative action." The investigator will make judgements and recommendations concerning the curriculum. However, the ultimate decision as to the implementation of those recommendations rests with the school's administrators.

The standards considered in the Judgement Matrix were absolute standards, i.e. they were considered solely with respect to the course under study - in terms of the course's own objectives. The other type of standards, known as relative, would have involved comparisons between factors studied in the present course and similar factors in other comparable courses (e.g. Army, Air Force and Marine Corps Recruiting Courses). In referring to the issue of relative versus absolute standards, Stake (1973, p. 123) has paraphrased Cronbach's contention that "the difference in purpose of various programs being compared is likely to be sufficiently great to render uninterpretable any outcome other than the across-the-board superiority of one of them." In deference to this contention, the investigator decided that evaluation of relative standards would cloud the purposes of the current study, and divert attention to more ancillary considerations. Thus, this study was concerned only with judgements based on absolute standards internal to the revised course.

The Populations to be Studied

Three distinct populations were studied, each composed of five classes of students in the Enlisted Recruiter course of instruction at the Navy Recruiting Orientation Unit, in Orlando, Florida. The populations included 111, 222 and 101 subjects, respectively. The primary reason for the fluctuation was due to the school's lack of control over student loading into the course. Three cases were deleted from the study, two in the first group and one in the third. These deletions were due to circumstances beyond the school's control, and were unrelated to academics. This brought the size of the three populations to 109, 222 and 100 respectively.

Because separate groups of subjects were studied at widely spaced points in time, they were considered independent populations, rather than samples of some larger homogeneous group. Of course, considering each group as an intact population precluded the ability to make statistical inferences from the findings of the study to a larger group. However, in terms of the evaluative nature of this study, such inferences were considered unnecessary.

Instrumentation and Data Collection

To provide data for answering the study questions posed earlier, several types of data were collected and analyzed. The questions concerning student attrition rate, for example, required the collection of specific data regarding numbers of students in each evaluation cycle who had academically failed the course. The school's personnel department provided these data to the investigator. The attrition data were categorized by the personnel department according to reason for attrition. Of the reasons tabulated, only those directly related to academic performance were considered in this study (e.g. consistent academic performance below 75% in weekly exams, and inability to perform activities involving sales skills to a 75% minimum level). Other attrition categories (e.g. medical or personal problems, alcohol and drugs, lack of a valid driver's license, etc.) were not considered in the attrition rate computations, as these had no bearing on the curriculum content or structure of the course.

The question concerning student roll-back rate required data on the number of weekly course failures which resulted in the student repeating the failed week of instruction, but did not result in immediate attrition. These data were available from students' academic records. No distinction was made between those students who were rolled-back once and those rolled-back more than once in the course. It was decided that such a distinction would not provide information useful in this particular study. This decision was based on the results of an earlier pilot study conducted by the investigator which revealed no consistent correlation between the number of roll-back incidents per student and whether or not the student eventually failed the course. Several students in each evaluation cycle were administratively rolled-back for non-academic reasons, such as medical or emergency leave, etc. As was the case with attrition data, such instances were not counted in the final roll-back rate computations.

The question concerning graduates' perceptions of course relevance to real-world recruiting practices was addressed with data gathered via a post-graduate feedback survey. The survey was mailed to course graduates three months after graduation. The investigator-developed survey consisted of 36 questions, each based on a major course objective (cf. Appendixes A and B). Graduates were instructed to rate their perceptions of the training they received on these course objectives in terms of their first three months of recruiting experience. The rating scale used was a five-point Likert-type scale:

1. Task not performed; eliminate from training
2. Training more than adequate; reduce emphasis
3. Training adequate for the task
4. Training less than adequate; increase emphasis
5. Training requires MUCH more emphasis in school

Feedback was solicited from graduates of each evaluation cycle of the revised course, as well as from graduates of the traditional course.

Data concerning instructional procedural fidelity were provided by means of an in-place administrative report detailing usage of the school's closed-circuit audiovisual system. During development of the revised course sequence, weekly course schedules containing audiovisual requirements were created as operating documents for instructors and audiovisual technicians. The technicians were required to document all audiovisual usage on a daily basis for each week of instruction. The documentation identified three predominant categories for each week of instruction: 1) audiovisual sessions which occurred as scheduled, 2) audiovisual sessions which either did not occur as scheduled, or occurred at other than scheduled times, and 3) audiovisual sessions requested by instructors but not appearing on the appropriate weekly schedule. Any reported incidents falling into category #2 were considered course deviations only if the actual showing of the audiovisual session differed from that scheduled by more than one hour. During the first evaluation cycle, this leeway was granted because of instructor uncertainty in estimating the amount of classroom time needed to teach a subject under the revised course sequence. For the second and third evaluation cycles, the leeway was reduced to 30 minutes. The need for leeway allowances was deemed necessary by the investigator, even in the later evaluation cycles, because of anticipated time fluctuations which normally occur in even the most routine classroom transactions, due to unanticiapted student questions, discussions designed to clarify student misunderstandings, etc.

Instrument Validity

Other than in-place administrative reports required by the school, the only data collection instrument used in the study was the graduates' feedback survey (see Appendix C). The investigator assumed that both of these sources provided valid data. The survey was composed of items which identically matched objectives taught in the course. Furthermore, the course objectives were originally derived from a job listing of tasks routinely performed by professional enlisted Navy Recruiters. During the early development phases of the course, tasks were mapped into either a one-to-one or a many-to-one correspondence with the course objectives. The many-to-one correspondence scheme was used to consolidate clearly-related task elements. Appendix D contains the Recruiter Canvasser Job Task Inventory, Appendix E contains the Recruiter Canvasser course objectives derived from the job task inventory, and Appendix F displays the correspondence between job tasks and course objectives.

Potential Error in Measurement

There were four variables of interest in the current study: 1) academic attrition rate in each evaluation cycle, 2) academic roll-back rate in each evaluation cycle, 3) graduates' perception ratings of course relevance to real-world recruiting practices in several content areas, and 4) instructional procedural fidelity, as measured by audiovisual usage records. Each of these variables was measured in every evaluation cycle of the revised course. In the traditional course, only academic attrition data and graduates' survey results were available from historical records.

The potential measurement error for the first two variables dealt with accurately gathering the data. In the traditional course, only historical records of academic attrition data were available. More importantly, the school had no historical records to indicate the criteria which governed academic attrition procedures in that course. The lack of this information forced the investigator to assume that the operative criteria governing academic attritions in the traditional course were the same as those used in the revised course.

The third variable, the perception ratings of course graduates, was subject to a potential sampling error arising from the possibility that the return rate from the graduates would be so small that a confident prediction of the graduates' true perceptions could not be made. To overcome this, a minimum sample size was computed to determine the minimum number of surveys needed to be mailed to ensure at least a 20% return rate. According the the Navy's Training Analysis and Evaluation Group, this 20% figure represented an acceptable return rate for mailed questionnaires (R. Braby, personal communication, September 20, 1980). The computations, which are detailed in Appendix G, yielded a sample size of 100% of the populations studied. Thus, surveys were mailed to all course graduates from each evaluation cycle.

The fourth variable, instructional procedural fidelity, was potentially affected by errors in recording deviations from the published course schedules. Since there was no subjectivity involved in identifying schedule deviations (all deviations were apparent from reading the published schedule), the only potential errors were those caused by the technicians in forgetting to annotate deviations as they occurred. The amount of such error is unknown.

Justification for Multiple Evaluations

There was reason to suspect that the Hawthorne effect could potentially inflate any differences discovered in favor of the revised course. To adjust for this potential inflation, the second and third rounds of evaluation were planned to be conducted at one, and one and one-half year intervals after the initial evaluation. If differences among the three evaluations were found to either consistently decrease or stabilize at a positive level in favor of the revised course, then it would be concluded that the revised course sequence was at least as effective as the sequence of the traditional course regarding the variables studied.

Additional Analysis Strategies

The Countenance Evaluation Model possesses its own analysis strategies designed to ensure the internal validity of the model as it is applied to the instructional program under investigation. Specifically, the data generated in the Description Matrix (see Figure 1) are analyzed to determine the answer to three principal questions. The first question, To what degree do the antecedents, transactions and outcomes come to pass?, is a measure of the congruence between what is intended and what is observed to occur. Two important points, however, need to be made. "First, it may be that incongruence (little or no match between intents and observations) is desirable in the long run, especially if the intents can be shown to be invalid for some reason. Second, congruence does not assure validity, only fidelity . . ." (MacKay and Maguire, 1971; p. 31). This second point is readily apparent by recognizing that the concept of congruence is similar to reliability, and further, that reliability is a necessary but not sufficient condition for validity.

The second question is of the following form: If the students and the instructional program possess all the intended antecedents, and if the instruction follows all the intended transactions, is it reasonable to expect the intended outcomes to occur? This question is concerned with the logical (or intended) contingency of the course being evaluated.

The third question to be asked is similar to the second. However, rather than dealing with intents, this question deals with actual observations. The question is of the following form: When the antecedents are verified, and when the instructional transactions actually occur, do the observed outcomes occur as intended? This question concerns the empirical (or observational) contingency of the course.

Descriptive Analysis

Analyzing the descriptive data for congruence, logical contingency and empirical contingency provides information useful in making recommendations and decisions to retain, alter or abandon portions of the instructional program. Additionally, these analyses provide information which indicates whether or not initial intentions were realistic. The information is useful for designing follow-up evaluations of the same program, which should evolve toward more realistic determinations of intended antecedents, transactions and outcomes. Such a process leads to more realistic judgements and stronger recommendations based on those judgements. These three analytical relationships are illustrated in Figure 5. (Note: Numbered paragraphs are used to facilitate cross-referencing between the sections which follow.)

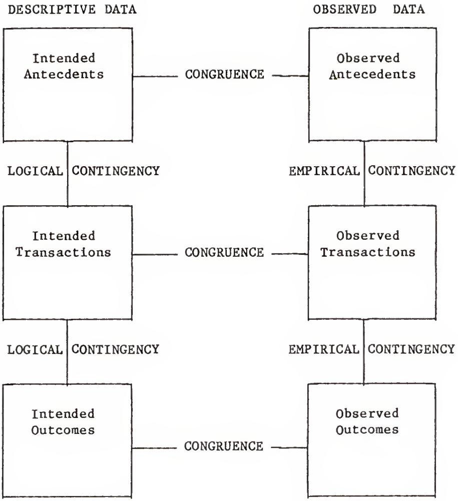


Figure 5. The Relationships Among Three Types of Analysis in the Countenance Evaluation Model

Intended antecedent

1. Entering Students possess no previous knowledge of course material. Data on this antecedent were necessary to determine the effects on the other findings of the study.

Data sources and procedures for observing antecedent

1. A course pretest was used to measure student entry level knowledge of recruiting. The pretest was administered to subjects in the first evaluation cycle. The test was composed of a sample of questions from weekly course exams. It was expected that students with no previous knowledge of course material should score at an average guess rate of 25% or less. This rate was determined because the pretest contained multiple-choice questions with four alternatives each.

Intended transactions

1. The course is structured into five week-long modules. These modules are sequenced in a spiral fashion, with subsequent weeks' instruction designed to elaborate on concepts presented in the earlier weeks of the course.
2. To ensure that all classes of students receive the same amount of instruction in each week, published course schedules must be strictly adhered to insofar as the timing of topic presentations and audio-visual presentations.
3. Course objectives specify student performance in behavioral terms (both cognitive and psychomotor). These objectives

should be patterned closely after actual tasks performed by recruiters in the field.

Data sources and procedures for observing transactions.

1-2. Physical observation of classroom transactions was required to adequately monitor the spiraling of instructional content from week to week, and to ensure that course schedules were being adhered to as much as practical. The essence of a spiral instructional sequence requires that concepts presented early in the course be frequently referred to throughout the course and integrated into new concepts taught later. Observations of the instructional sequence should be accomplished unobtrusively with the aid of audiovisual records indicating usage rates of the closed circuit television (CCTV) system. By comparing this record against the published course schedule, protracted sequence breaks can be monitored precisely. Because the revised course employed CCTV during every day of the course, this method of sequence checking was assumed to be a valid means of verifying adherence to the course schedule.

3. Surveys of course graduates were to be solicited three months after graduation to gather data concerning the real-world applicability of course content as perceived by the graduate. Mean perception ratings were computed for each survey item from the raw data provided by respondents.

Intended outcomes

1. Academic attrition rates in the revised course were expected to show a decreasing trend over the duration of the evaluation study.
2. Academic roll-back rates measured across all evaluation cycles were expected to either decrease or stabilize. Because there were no data available on roll-back rates from the traditional course, it was only possible to analyze roll-back rates across different evaluation periods of the revised course.

Data sources and procedures for observing outcomes

1, 2. Data were available weekly concerning: 1) the number of academic attritions from the course, and roll-backs into previous weeks of instruction, 2) the class to which the students were initially assigned and 3) the reason for attrition or roll-back. All attritions and roll-backs were tallied each week and accumulated for each evaluation cycle. Attrition rate (A) and roll-back rate (R) were computed as follows:

$$A = \frac{\text{Total academic attritions per evaluation period}}{\text{Total population enrolled during the period}}$$

$$R = \frac{\text{Total academic roll-backs per evaluation period}}{\text{Total population enrolled during the period}}$$

Logical Contingency Analysis

The need for the Intended Antecedent lies in the possibility that students' prior knowledge of course material could influence the ultimate transactions and outcomes by inflating their apparent effectiveness. Thus, prior-knowledge level must be assessed and considered in any decisions regarding the merit and worth of the revised instructional program.

The first two Intended Transactions were designed to determine if the intended spiral sequence was actually implemented as reflected in the course schedules. The third Intended Transaction was designed to compare the theoretical fidelity of course content to actual field recruiting tasks against the fidelity perceived by course graduates.

Both Intended Outcomes relate to the effectiveness of the revised course in terms of its ability to reduce or stabilize the rates of academic attrition and roll-back. Analysis of these rates across all three evaluation cycles may show a trend. It was expected that, if trends occurred, they would be either decreasing or stable. Such trends would lend support to the long-term effectiveness of the revised spiral-sequenced curriculum, regarding attrition and roll-back rates.

The Congruence between what is intended and what is observed, as well as Empirical Contingency between observed antecedents, transactions and outcomes must await presentation of the observational data. These issues are discussed in Chapter IV.

CHAPTER IV

FINDINGS

In addition to the Description Matrix presented earlier, the Countenance Model of Evaluation also contains a Judgement Matrix made up of STANDARDS and JUDGEMENTS (see Figure 4). By measuring differences between the Intents and the Observations of what transpired during the evaluation against pre-established Standards, Judgements were made as to the efficacy of the revised curriculum. As mentioned, the Standards used in this study were absolute - that is, they did not contain criterial references to external courses. The following numbered paragraphs delineate the Standards used in this evaluation study; they correspond with identically numbered paragraphs in the previous chapter.

Standards For Antecedent

1. Class averages for the course pretest should not exceed 25%, the estimated average guess rate for a test composed of multiple choice questions with four alternatives each. If the mean pretest score of the population does not exceed 25%, then the indended antecedent, that students entering into the courses possess no substantial previous knowledge of course material, is verified.

Standards For Transactions

1, 2. Course deviations and unscheduled audiovisual requests, which were used to determine the level of instructional procedural fidelity, were expected to exist regardless of the type of course sequence in effect. This was expected because part of the school's philosophy was to encourage the instructor staff to experiment with new instructional methods and teaching techniques in the classroom, which had the potential to cause various degrees of deviation from the published schedule. Therefore, overall findings which indicated a declining or stabilizing trend in schedule deviations were acceptable as evidence that the instructional staff had adapted to and were willing to follow the revised course sequence.

3. Course objectives should be patterned after actual tasks performed by recruiters in the field. This helps to ensure that school-based training is relevant to actual field operations. Early in the course's development, the school's administration determined that some recruiting tasks were neither feasible nor economical to train in a resident school setting. Thus, after its development, the Recruiter Job Task Inventory (Appendix D) was subdivided into two categories - those tasks which were trainable at the resident school, and those which were not. The subdivision was performed by a team of experienced recruiters and in-house curriculum designers. This

subdivision is indicated in Appendix D as follows: tasks to be trained at school are shown in bold print, while all other tasks are indicated in normal print. Therefore, if course objectives can be linked to actual tasks from the inventory, there is support for the contention that the course was designed to train to actual recruiting practices. Furthermore, if analysis of graduates' surveys indicates that graduates of the revised course perceive their training as more adequate for performing real-world recruiting tasks than do those graduates of the traditional course, then both of these findings can be taken together as evidence that the revised course design actually did result in an improved perception of the fidelity of resident training. An opposite finding would, of course, indicate that the traditional course was perceived to possess a greater fidelity to real-world recruiting.

Standards For Outcomes

1, 2. It was impractical to expect either academic attritions or roll-backs to be eliminated entirely as a result of the spiral course design. Although it can be argued that a true competency-based curriculum generates no failures, in the case of a military-related training course such as the one under study, there are realistic constraints of time and budget that necessitate the imposition of attrition criteria. Also, in this particular course, the Recruiting Command Headquarters, in response to Congressional directives, imposed a maximum ceiling on attritions of no more than 25% of the total student enrollment. If the course exceeded this ceiling, it had to be examined and revised as necessary. Thus, within the framework of these two constraints, findings that indicated a declining or stabilizing trend in academic attritions and roll-backs were accepted as evidence that the revised course was at least as effective as the traditional course in these two areas.

The results of each evaluation cycle are presented in separate sections of this chapter. Following the convention established in Chapter III, numbered paragraphs are again used to facilitate cross referencing between and among the sections which follow.

Results of Evaluation Cycle One

Actual Observation of Antecedent

1. To determine whether or not students possessed prior knowledge of course content, course pretest scores were analyzed to determine if they differed from the presumed minimum 25% guess rate. Table 1 lists descriptive statistics for the pretest scores of each of five classes observed during evaluation cycle one. The standard deviations among the classes appeared to fluctuate, although they were all of the same order of magnitude. Comparison of mean, median and mode for each class revealed that four of the classes

Table 1. Pretest Descriptive Statistics for Evaluation Cycle One

Class Number	Mean[a]	Median	Mode	S.D.	Distribution
82-08 (N=12)	43.56	46	46	6.86	Negative Skew
82-09 (N=10)	43.01	43	None	8.14	Uniform[b]
82-10 (N=11)	50.36	50	60	9.08	Positive Skew
82-11 (N=13)	43.69	40	36	6.66	Positive Skew
82-12 (N=10)	39.30	36	36	7.79	Positive Skew

[a] Overall Mean = 43.98. [b] This distribution was essentially rectangular.

exhibited skewness in their distributions, while one appeared to be nearly rectangular. Based on mean and median statistics, all classes appeared similar in make-up regarding their levels of prior knowledge, and that the overall mean was higher than the guess rate. However, the pattern of standard deviations indicates consistently variability across classes. An explanation for this relatively large variability may be that some of the material presented in the course, especially that dealing with techniques of selling, is not generic to Navy Recruiting. Entering students appeared, from the data, to possess varying amounts of such knowledge. Overall, the assumption that entering students would score at a "guess rate" level on the pretest was not empirically verified.

Actual Observations of Transactions

1. The spiral course sequence was verified through a correlation analysis of weekly achievement scores (Table 2). The bracketed correlations in the table indicate a moderate to high positive correlation (greater than 0.40) between and among various weeks of the revised course. For example, Week One achievement correlated positively with Weeks Two and Five. Week Two correlated positively with Weeks Three and Five, and Week Three correlated positively with Weeks Four and Five. This close interrelationship among weekly achievement scores could be due simply to the fact that

Table 2. Specific Pearson Correlations For Evaluation Cycle One

	1	2	3	4	5
1. Week 1 Score					
2. Week 2 Score	[.68]				
3. Week 3 Score	[.43]	[.49]			
4. Week 4 Score	.30	.35	[.75]		
5. Week 5 Score	[.73]	[.84]	[.55]	[.43]	

NOTE: Brackets indicate notable correlations (see text) brighter students learned more all through the course. However, if it is assumed that classes were composed of students with a random mix of achievement potential, then the correlations suggest that the spiral sequence was maintained throughout the course. That is, concept attainment in the early weeks of the course was apparently related to achievement in later weeks, where those concepts were reiterated and expanded.

2. On the whole, instructional procedural fidelity (actual classroom transactions) closely followed the spiral sequence embodied in the course schedules. There were, however, several minor schedule deviations. Table 3 enumerates the deviations that occurred during the period 22 February through 26 February 1982:

   Week 1: Student-Instructor (S-I) interactions were slow to develop, due primarily to the "newness" of the training situation for the students. However, the instructors were patient and prodding, and as the week progressed, S-I interactions increased. Because a workshop did not take place on the fifth day of the week as scheduled (see Table 3), the planned interaction of this activity was not observed.

   Week 2: The level of S-I interaction perceived by the investigator was higher in this week than that observed in Week 1. This was presumed to be due to the nature of the subject matter (sales techniques) as well as the

TABLE 3. Course Deviations (CD) and Unscheduled Audio Visual Requests (UAV) For Evaluation Cycle One (1982)

Date	Discrepancy
22 Feb	Show "Sales Demo" tape for Week 2 (UAV)
23 Feb	Week 3 scheduled "AAA #3" - never called for (CD)
24 Feb	Show "AAA #3" for Week 3 (UAV) Show "AAA #3" for Week 4 (UAV) Week 5 - Manuals not page checked (CD)
26 Feb	Week 3 scheduled "AAA #5&6" - not called for (CD) Week 3 - exam given in morning rather than afternoon (CD) Week 1 - workshop not conducted (CD)
1 March	Show "Sales Demo" tape for Week 2 (UAV)
5 March	Show tape "Phillipinos in Recruiting" Week 3 (UAV) Week 1 - workshop not conducted (CD)
9 March	Show "AAA #4" for Week 3 (UAV)
10 March	Week 5 - Administered Recruiting Manual Exam in morning rather than afternoon (CD)
12 March	Week 1 - workshop not conducted (CD)
15 March	Show tape "Sales Demo" tape for Week 2 (UAV)
16 March	Tape sales labs for Week 2 (UAV) Week 3 scheduled "AAA #3" - never called for (CD)
19 March	Show "AAA #3" for Week 3 (UAV) Show "AAA #6" for Week 4 (UAV) Week 1 - workshop not conducted (CD)
23 March	Week 3 scheduled "AAA #3" - never called for (CD)
25 March	Show "AAA #3" for Week 3 (UAV)
26 March	Show "AAA #6" for Week 4 (UAV) Week 1 - workshop not conducted (CD)

observed intensity and vitality of the instructors in this week of the course.

Week 3: Interactions between students and instructor were observed to be less intense in this week than had been observed in Week 2. One student commented that it was hard to keep his attitude high, but that the instructors made an effort to boost and maintain his attitude throughout the week.

Week 4: To emphasize the spiral nature of the revised course sequence, there was need for content recapitulations, scheduled at the beginning of each week of the course, from Week 2 through Week 5. The intent of these recapitulations was to help students merge concepts learned in the previous weeks, as well as those to be taught in the current week, into an expanding picture of recruiting. Since no new information was scheduled to be presented in Week 5, the most extensive of the weekly recapitulations occurred as the first scheduled lesson in Week 4. One instructor, especially knowledgeable in recruiting practices, developed a four-hour group discussion lesson designed so students could fit their acquired knowledge of recruiting concepts into a detailed picture of the recruiting process. It was hoped that this activity would aid students in internalizing an integrated model of recruiting. The rest of the week's instruction was tied into this integrated model.

By the end of the week, the total recruiting process had been presented to the student. This approach to Week 4 represented a total departure from its function in the traditional course. Observations of the week revealed that the level of S-I interaction was dependent upon which instructor was teaching. As expected, the instructor who designed the week's activities produced the greatest amount of S-I interaction. It was also observed that during this week other instructors reverted to the traditional passive-student lecture. It became apparent through such observations that several instructors were not committed to the spiraling concept as embodied in the course sequence.

Week 5: In its revised form, Week 5 was designed to present no new information. Rather, it was to be a week wherein students would apply the knowledge they had acquired in previous weeks to both actual and hypothetical recruiting situations. All of these situations involved a very high level of S-I interaction.

3. The relationship between course objectives and job tasks is illustrated in Appendix F. Together with Appendixes D (Recruiter Job Task Listing) and E (Course Objectives List), Appendix F reveals the close correspondence between instructional objectives in the revised course and actual field recruiting tasks. This correspondence

supports the contention that a high degree of positive transfer of training from the school environment to the field environment was planned into the design of the course. Since no record of a formal task analysis was available for the traditional course, no comparison could be made between degrees of task-objective correspondence in the two courses.

Graduates' perceptions of the course were analyzed to determine if the _planned_ correspondence was also _perceived_ by graduates of the course. These perceptions were measured via a post-graduate survey. The investigator conducted a comparative analysis between surveys from graduates who had attended the traditional course and surveys from graduates of the revised course. All groups were surveyed three months following their graduation. The respondents from the traditional course accounted for 21% of the graduates surveyed, while those from the revised course accounted for 30% of the graduates surveyed. As described in Chapter III, a five-point response scale was used. The ratings on the scale were:

1 - Task not performed; eliminate from training
2 - Training more than adequate; reduce emphasis
3 - Training adequate for the task
4 - Training less than adequate; increase emphasis
5 - Training requires _MUCH_ more emphasis in school

The findings of this comparative analysis are shown in Figure 6. The open circles in the figure indicate the mean responses of graduates from the traditional course. The solid circles indiate the mean responses of graduates from the revised course. Numbers along the bottom of the graph (1 through 36) indicate questions on the graduates' survey (cf. Appendix C). The scales on either side of the graph indicate the response values. Since the survey results of each group were arithmetically averaged, it was possible to obtain a virtually continuous range of ratings from 1.0 to 5.0, rather than only five discrete values.

There is a considerably higher degree of variability in the percieved applicability of the training received in the traditional course (mean variance = 0.17) compared to that in the revised course (mean variance = 0.03). That is, the perceptions of graduates from the revised course appear to deviate much less about the 3.0 reference level (dashed line) than do perceptions of graduates from the traditional course. This lends support to the contention that the revised course may have a higher perceived fidelity to real-world recruiting, thus producing a more effective positive transfer of training, than did the traditional course.

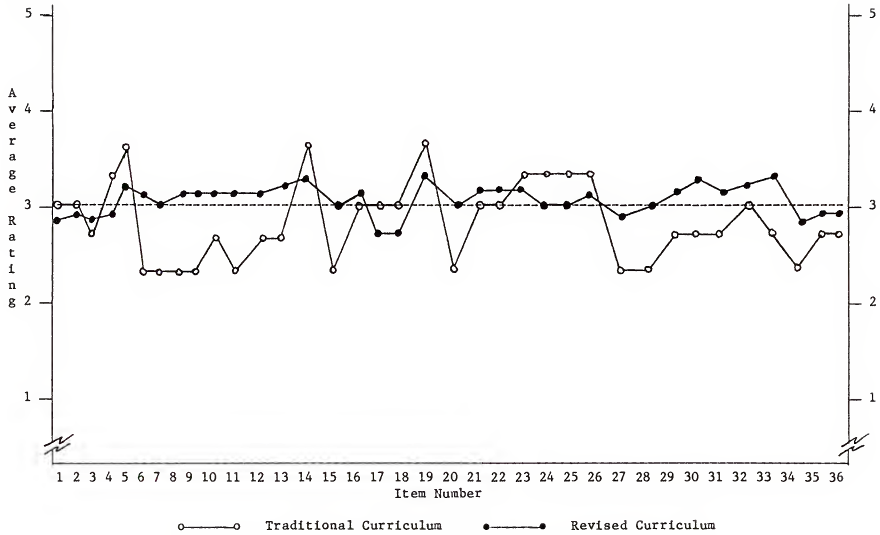


Figure 6. Comparison of Graduates' Perceptions of Course Adequacy Between the Traditional and Revised Curricula (Evaluation Cycle One)

Actual Observations of Outcomes

1. The academic attrition rate in the five traditional classes was four out of 110 students (3.6%). During the first evaluation period of the revised course, seven academic attritions out of 109 students (6.4%) were noted. The specific reason for the increase in attrition in the first evaluation period is unknown. Some plausible reasons for this increase are, first, the rise in the attrition rate in the first evaluation period of the revised course may be due to a possible increase in the difficulty of the course caused by the new course sequence; second, the increase could be due to the possibility that poor attrition record keeping in the traditional course produced lower than actual figures, thus leading to an apparently deflated attrition rate in the traditional course; third, the increase could be due to a chance variation caused by the relatively small population size. A fourth possibility could be a combination of all of the above possibilities. A fifth possibility relates to the number of schedule deviations discovered throughout the course (Table 3). These data suggest some degree of reduction in the instructors' committment to the spiral sequence of the revised course. Since such a reduction was found to occur, it may have impaired student comprehension of the intricate relationships in the course content. If the instructors exacerbated this condition by ignoring the spiral sequence of the course, this could have easily led to the rise in the rate of academic attrition observed in the data.

2. Data concerning academic roll-backs were not available for the traditional course, since they had not been maintained by any department at the school prior to the beginning of the revised course. Thus, a comparison between the traditional and revised courses on this dimension was not possible.

Results of Evaluation Cycle Two

Actual Observations of Antecedent

1. For this evaluation cycle, the course pretest was discontinued due to the non-availability of a suitable time slot during the new-student orientation period. Time that had been allotted for administration of the pretest during the first evaluation cycle was re-allocated in the current cycle for other types of student testing.

Actual Observations of Transactions

1. During the second evaluation cycle, correlations among weekly achievement scores were found to be slightly lower than those of the first evaluation period. Table 4 shows comparative achievement correlations for the first and second evaluation cycles. As evidenced in the data, the higher correlations reported in the first evaluation cycle are generally associated with lower correlations in the second cycle, while the more moderate correlations from cycle 1 appear to have remained fairly consistent with those of cycle 2. Although these intra-course correlations generally decreased in the second evaluation period, they remained at a moderate level. Chance variability cannot be ruled out as an explanation for

Table 4. Comparative Correlations Between Evaluation Cycles One and Two

	1	2	3	4	5
1. Week 1					
2. Week 2	.68/.30				
3. Week 3	.43/.54	.49/.40			
4. Week 4	.30/.48	.34/.29	.75/.59		
5. Week 5	.73/.41	.84/.28	.55/.52	.43/.47	

NOTE: Correlations reported in the table are presented in the following form: Cycle One/Cycle Two these correlation shifts, because correlations from small sample sizes are exceedingly unstable. Assuming chance variability as the cause for the changes in correlation coefficients leads the investigator to conclude that content and minor sequence changes made to the course prior to the second evaluation period apparently had no measurable positive or adverse effects on the integrity of the spiral sequence originally designed into the revised course.

Specific topics dealing with sales techniques, pre-enlistment kit preparation and production analysis, which had been spiraled through every week of the course in the first evaluation cycle, were shifted in such a manner that they were no longer spiraled through every week. This was a school administrative action which was beyond the control of the investigator.

The computer program that derived the original sequence for the revised course was used in the second evaluation cycle to determine the degree to which the changes made to the curriculum detracted from the original spiral design. Analysis revealed that no major breaks in the logical sequence of the course content were introduced by these changes. However, several strong transitions between related topics were weakened as the topics were spaced farther apart in the course. Considering the results shown in Table 4, these sequence changes may or may not have had an effect on the strength of the correlations between student weekly examination scores.

2. The number of course deviations occurring in the second evaluation period decreased dramatically from the level found during the first evaluation cycle. Table 5 enumerates the schedule deviations recorded during the second evaluation period, 18 April 1983 to 15 July 1983. Observations of student-instructor (S-I) interactions in each week of the course revealed the following:

   Week 1: As was observed in the previous evaluation cycle, S-I interactions were slow to develop throughout the week. The student workshop, previously scheduled on the fifth day of the week, had been discontinued in the interim between evaluation cycles. This eliminated a potentially effective avenue for S-I interactions in the week. The norm for the week was lecture, which resulted in a meager level of S-I interaction. Students received feedback on their progress via three morning quizzes on the second, third and forth days of the week. These quizzes covered material presented in previous lessons, as well as material covered in nightly homework assignments.

   Week 2: There was no observed change in either the level of S-I interaction or in the content presented during the week compared with that observed in the first evaluation period.

   Week 3: Observations revealed no major changes in this week's transactions from those reported in the first evaluation period.

Table 5. Course Deviations (CD) and Unscheduled Audio Visual Reqests (UAV) for Evaluation Cycle Two. (1983)

Date	Discrepancy
29 April	Show "Navy Campus" film for Week Three (UAV)
3 May	Show film on "Drugs and Driving" for Week 5 (UAV)
9 May	Week 5 "Time Management" film - never called for (CD)
13 May	Show "Navy Campus" film for Week Four (UAV)
10 June	Week 3 film "One for the Road" - never called for (CD)

Week 4: The primary function of this week was to present detailed operations of recruiting tracking and production analysis systems (the theory of which was presented in Week 3). Observations by the investigator revealed a level of S-I interaction relatively higher than that found in Week 3. Presumably, this was due to the fact that students had been exposed to these concepts in the preceeding week.

Week 5: Since the inception of the revised course, this week was planned to be an applications week - a time designed for students to apply the concepts learned previously in the course in both hypothetical and actual recruiting situations. The instructor-supervisor of Week 5, appointed shortly before the beginning of the second evaluation period, developed a series of application workshops for the week. The implementation of these workshops created a level of S-I interaction, perceived by the investigator, to be equal to that observed in Week 2, and higher than that observed for Week 5 during the previous evaluation period.

3. Because no instructional objectives were added to or deleted from the course between the first two evaluation cycles, there was no change in the theoretical correspondence between course objectives and field recruiting tasks. To put this in perspective, the correspondence ratings perceived by the course graduates were analyzed. Figure 7 presents a comparative graphic analysis of graduate perceptions in the first two evaluation cycles of the revised course. The scales

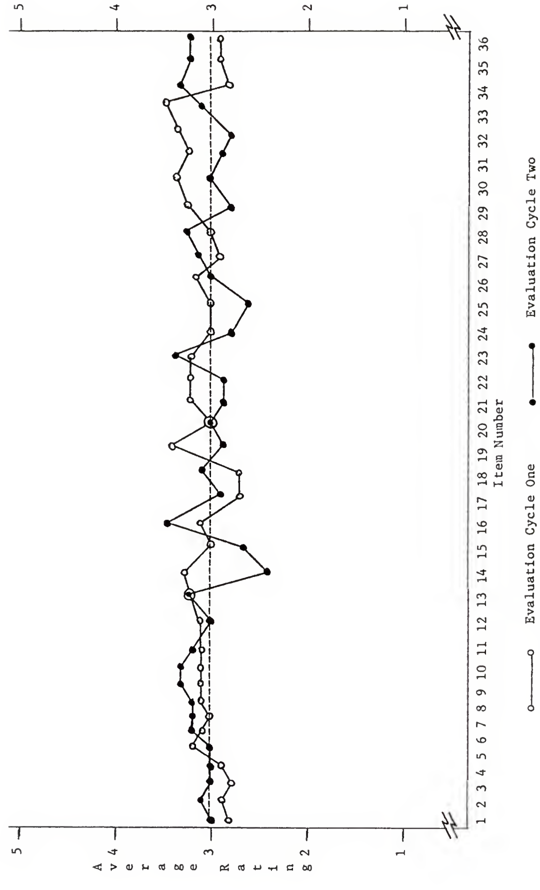


Figure 7. Comparison of Graduate Perceptions of Course Adequacy Between the First and Second Evaluation Cycles of the Revised Course

on the bottom and sides of the graph have the same meaning as in the graph of Figure 6. The open circles represent the mean of responses for graduates from the first evaluation cycle, while the solid circles represent the mean of responses for graduates of the second cycle. The mean variance in the perceived applicability of school training by graduates of the first cycle was 0.03, whereas the mean variance in responses from the second cycle was 0.05. The slight increase in mean variance in the second cycle was still considerably less than that for the traditional course, whose mean variance was 0.17 (cf. Figure 6). This indicates that graduates of the second evaluation cycle perceived overall training fidelity to be nearly the same as that of the first cycle. Together, these two findings support the contention that the revised course had a higher perceived fidelity than did the traditional course.

Actual Observation Outcomes

1. During the second evaluation period, academic attrition accounted for 14 losses out of 222 students (6.3%). The slight decrease in academic attrition rate between the second cycle and the first, with a 6.4% reported rate, indicates that the revised course remained essentially stable over the two cycles with regard to academic attrition rate. Yet, this rate was still higher in the revised course than that determined for the traditional course.
2. The academic roll-back rate for the second cycle was computed to be 15% (34 roll-backs out of 222 students enrolled).

Compared with the computed roll-back rate for the first cycle, 28% (30 out of 109), it was evident that the second evaluation cycle experienced a dramatic decrease in intra-course failures over the first cycle. Coupled with the slight decrease in academic attrition rate, this finding lends support to the contention that instruction in the second cycle led to greater student comprehension of material than in the first cycle. This finding also implies that the Hawthorne effect may not have had as strong an effect on the revised course as was initially anticipated.

In summary of the first two evaluation cycles, the predominant findings were:

1. Intra-course achievement correlations were generally lower than those of the first cycle,
2. Academic attrition rate decreased slightly from its level in the first cycle,
3. Academic roll-back rate decreased sharply in the second cycle, and
4. Recorded occurrences of schedule deviations declined sharply in the second cycle.

Finding 1 implies that the spiral nature of the course sequence had deteriorated somewhat in the second cycle. Three possible reasons for this finding are: 1) the student groups in these cycles were different, and these differences accounted for the decrease, 2) sequence changes imposed on the course prior to the second cycle accounted for the variance in the correlations, or 3) a chance variation. It is not possible with the available data to refute either the possibility that the two populations were different academically, or that variations were due strictly to chance.

However, regarding the second explanation, the sequence changes that were made were apparently more functional for the instructor staff as evidenced by the sharp decline in schedule deviations (finding 4). This finding suggests that instructors could more easily teach the modified spiral seuqence and, as a result, help the student relate to it more easily. Early in the course's development, it was presumed that if students understood the spiral nature of the course material, they would have a greater probability of internalizing the concepts presented; thus, they should perform better in school. Finding 3 supports this supposition. It seems reasonable to suspect that schedule changes instituted in the course accounted for at least a portion of the variance in academic correlations.

Results of Evaluation Cycle Three

Actual Observations of the Antecedent

1. The course pretest was not used during this evaluation cycle for the same reason described in evaluation cycle two, i.e. insufficient time was available to administer the pretest due to other administrative requirements.

Actual Observations of Transactions

1. Table 6 illustrates comparative correlation coefficients among student achievement scores in each week of the course,

Table 6. Comparative Correlation Coefficients Among Three Evaluation Cycles

	1	2	3	4	5
1. Week 1					
2. Week 2	.68/.30/.54 (.52)				
3. Week 3	.43/.54/.47 (.48)	.49/.40/.58 (.49)			
4. Week 4	.30/.48/.50 (.50)	.35/.29/.52 (.39)	.75/.59/.69 (.68)		
5. Week 5	.73/.41/.33 (.52)	.84/.28/.35 (.50)	.55/.52/.45 (.51)	.43/.47/.39 (.43)	

NOTE: Correlations reported in the table are presented in the following form: Cycle One/Cycle Two/Cycle Three. Numbers in parentheses are mean correlation values for each triplet (see text).

from all three evaluation cycles. To make these correlations more useful for comparative purposes, they were first normalized via a Fisher 'z' transformation, then, averaged to yield a mean, and finally transformed back into Pearson correlations. These means are displayed in parentheses directly beneath each triplet in the table. The means display a moderate correlation between student academic performance in various weeks of the course. The data appear to suggest a pattern of spiraling among the weeks that matches the planned spiral concept.

For example, the highest mean correlation in the table, that between Weeks 3 and 4, was expected due to the fact that Week 4 presented applications of the Activity Analysis content presented in Week 3. It was expected that students who did well, academically, in Week 3 would also do well in Week 4. The data, in this case, appear to substantiate the expectation. However, the correlations are not extremely strong, considering the large degree of spiraling designed into the course. Because the cycle three correlations do not establish consistent trends, they seem to support an explanation of chance variability. A possible reason for this can be found in the research of Bloom (1976) and others who have shown that a great many factors (not investigated in this study) affect variance in academic achievement, while instructional sequence accounts for only a portion of this variance.

2. Schedule deviations recorded during the third evaluation cycle were observed to be at their lowest levels since the beginning of the study. Table 7 enumerates the deviations recorded in the school's Audio Visual Usage records for the period 8 July 1983 to 30 September 1983. Observations of student-instructor (S-I) interactions throughout the course revealed the following:

   Week 1: As observed in the previous two evaluation cycles, S-I interactions were slow to develop. Students in this cycle received feedback on their progress via three morning quizzes on the second, third and forth days of the week, as in the previous cycle. These quizzes were identical to those administered to students during the second cycle.

   Week 2: There was no observed change in either the level of S-I interaction or in the content presented in the week from that observed in either the first or second evaluation period.

   Week 3: Classroom transactions were essentially unchanged compared to those observed in the previous cycle.

   Week 4: As in the second evaluation cycle, the primary function of this week continued to be a presentation of the detailed operations of recruiting tracking and production analysis systems. The high level of S-I interaction observed in the second evaluation cycle was still evident in the third cycle.

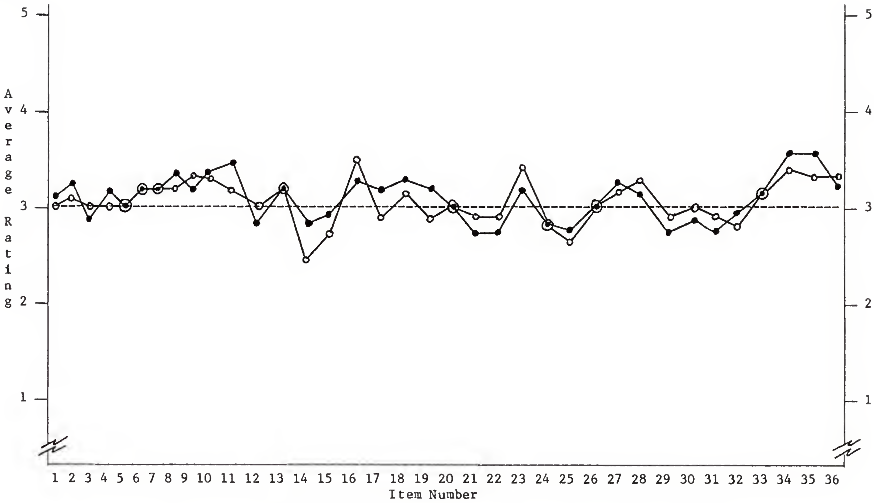
Table 7. Course Deviations (CD) and Unscheduled Audio Visual Requests (UAV) in Evaluation Cycle Three (1983).

Date	Discrepancy
14 July	Show "Sales Demo" tape for Week 2 (UAV)
21 July	Show "Sales Demo" tape for Week 2 (UAV)
8 Aug	Request to tape Week 5 Skill Labs (UAV)
2 Sept	Week 1 film "Navy Campus" - never called for (CD)

Week 5: As stated earlier in this chapter, this week was planned to be solely an applications week. However, counter to this initial intent, some new instruction was inserted into the week. This reduced the amount of time available during the week for student application labs, as compared with that observed in evaluation cycle two.

3. As was the case in the second evaluation cycle, no instructional objectives were added to or deleted from the course either before or during the third evaluation cycle. Thus, again there was no change in the theoretical correspondence between course objectives and field recruiting tasks.

The pattern revealed in graduates' perceptions of this correspondence, however, did change from that of the second cycle. Figure 8 shows a comparative graphic analysis of graduates' perceptions in the second and third evaluation cycles of the revised course. Table 8 displays mean perception ratings of graduates across the entire study. The scales on the bottom and sides of the graph have the same meaning as for the graphs of Figures 6 and 7. Open circles represent the mean responses of graduates from the second evaluation cycle, while the solid circles represent those for the third cycle. Mean variance in graduates' perceived applicability of school training from the second cycle was 0.05; while the mean variance in the third cycle was 0.06. Mean variance increased from the second to the third cycle, just as it had from the first cycle to the



○——○ Evaluation Cycle Two ●——● Evaluation Cycle Three

Figure 8. Comparison of Graduate Perceptions of Course Adequacy Between the Second and Third Evaluation Cycles of the Revised Course

Table 8. Mean Perception Ratings of Course Adequacy by Graduates from the Traditional and Revised Courses.

Item	Traditional Course	Revised Course Cycles I	II	III
1	3.0	2.8	3.0	3.1
2	3.0	2.9	3.1	3.3
3	2.7	2.8	3.0	2.9
4	3.3	2.9	3.0	3.2
5	3.6	3.2	3.0	3.0
6	2.3	3.1	3.2	3.2
7	2.3	3.0	3.2	3.2
8	2.3	3.1	3.2	3.4
9	2.3	3.1	3.3	3.2
10	2.7	3.1	3.3	3.4
11	2.3	3.1	3.2	3.5
12	2.7	3.1	3.0	2.9
13	2.7	3.2	3.2	3.2
14	3.6	3.3	2.5	2.8
15	2.3	3.0	2.7	2.9
16	3.0	3.1	3.4	3.3
17	3.0	2.7	2.9	3.2
18	3.0	2.7	3.1	3.5
19	3.6	3.3	2.9	3.2
20	2.3	3.0	3.0	3.0
21	3.0	3.2	2.9	2.8
22	3.0	3.2	2.9	2.8
23	3.3	3.2	3.3	3.2
24	3.3	3.0	2.8	2.8
25	3.3	3.0	2.7	2.7
26	3.3	3.1	3.0	3.0
27	2.3	2.9	3.1	3.2
28	2.3	3.0	3.2	3.1
29	2.7	3.2	2.8	2.7
30	2.7	3.3	3.0	2.8
31	2.7	3.1	2.9	2.7
32	3.0	3.2	2.8	2.9
33	2.7	3.3	3.1	3.1
34	2.3	2.8	3.4	3.5
35	2.7	2.9	3.3	3.5
36	2.7	2.9	3.3	3.2

second. Despite this increase, however, the overall variance was still lower than that observed for the traditional course. The perceived applicability of training to real-world recruiting was, apparently, consistently greater for the revised course than for the traditional course.

Actual Observations of Outcomes

1. During the third evaluaion cycle, academic attrition accounted for five losses out of 100 students enrolled (5.0%). Considered together, the attrition rates for all three evaluation cycles represented a consistent declining trend throughout the entire evaluation period of the revised course. This decline is illustrated graphically in Figure 9 (solid line). As mentioned earlier in this chapter, because historical attrition data were not available on a class-by-class basis for the traditional course, no relative comparisons between the two courses were possible on this dimension. The only available attrition rate for the traditional course was that quoted in the findings for evaluation cycle one (3.6%), which was not assumed to be representative of the traditional course. Two things can be said in favor of the revised course. First, a steady decline in academic attrition rates was observed over the duration of the evaluation study (cf. Figure 9). Second, all academic attrition rates, though higher than that in the traditional course,

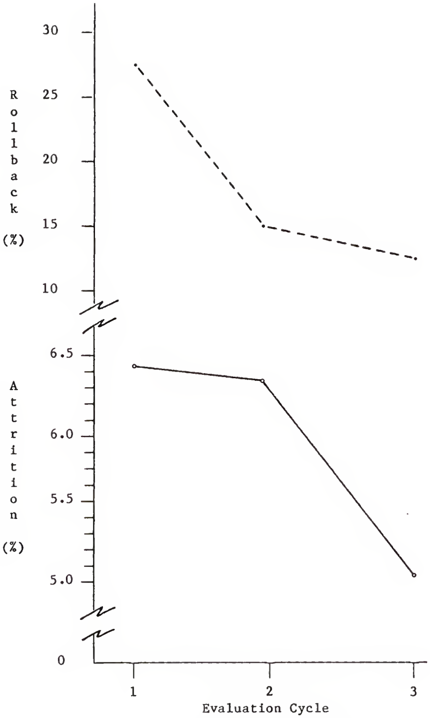


Figure 9. A Trend Line Plot of Academic Attrition Rates (solid line) Versus Roll-back Rates (dashed line) for the Revised Curriculum

were considerably less than the 25% ceiling established by the Navy Recruiting Headquarters Command.

2. The academic roll-back rate for the third cycle, computed to be 12% (12 out of 100 students), maintained a declining trend with the computed roll-back rates for the first and second cycles (28% and 15% respectively). As was the case with attrition rates, academic roll-back rates exhibited a consistently declining trend across all evaluation cycles (Figure 9, dashed line). This indicates that, over the duration of the evaluation study, instruction under the revised course sequence continually improved in producing increased student comprehension of material. However, this is not sufficient to indicate the superiority of the revised course over the traditional course, since no comparative roll-back data were available for the latter with which to make a definitive decision. The best that can be said is that the revised course sequence appears to be effective in long-term reduction of within-course academic failures (roll-backs).

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The remaining column in the Judgement Matrix of the Countenance Model is composed of judgements about the OBSERVATIONS (findings) based on the pre-established STANDARDS enumerated in the previous chapter. These judgements form the basis for the conclusions and recommendations contained in this chapter.

The purpose of the study was to evaluate several aspects of a revised course in recruiting techniques whose instructional sequence was based on Bruner's spiraling paradigm, and was generated with the aid of an investigator-developed computer program employing the Interpretive Structural Modeling (ISM) methodology. The revised course sequence was compared with a previous version of the same course which had been sequenced according to a manual Gagne-type methodology. Although not designed to determine the superiority of either sequencing methodology, this evaluation was designed to illustrate the efficacy of an ISM-developed curriculum.

Summary of Findings

1. Is there a difference in academic attrition rates between the traditional and revised courses?

Average academic attrition from the revised course (5.9%) was greater than that for the traditional course (3.6%). This does not mean, however, that the traditional course was necessarily more effective than the revised course, because there was no historical documentation specifying the criteria used in the traditional course's academic attrition process. The rate in the traditional course could, therefore, have been an anomoly produced by the particular (unknown) attrition criteria used. If it is assumed that this attrition rate were not anomolous, then the observed increase in attrition rate in the revised course, though surprising, is less disturbing due to the downward trend in the revised course's attrition rate across all evaluation cycles, as addressed in the following finding.

2. Is there evidence of either stability or consistent decline in academic attrition rates across several independent observations of the revised course?

Attrition rate in the revised course consistently declined throughout the evaluation period (Figure 9). This observed trend indicates that the revised course demonstrated long-term effectiveness in the ability to decrease academic attrition rate.

Because the three evaluation cycles were implemented during the late winter, early spring and late summer periods, it can be argued that the observed decline in academic attrition is a result of some type of seasonal variation in the student population attending the course during each evaluation cycle. The investigator does not consider this to be a valid concern, however, because there is no statistical basis for such variation in specialized Navy training schools. This is an area for future research.

On the basis of this steadily declining trend across the year-and-a-half-long observation period, the revised course appears to possess the capability of reaching a low level of attrition. Even if the traditional course's observed attrition rate were an anomoly, the investigator still concludes that the revised course was at least as effective as the traditional course based on reduction in attrition.

3. How do graduates' perceptions of the applicability of training to real-world recruiting requirements differ in the traditional course compared to those in the revised course?

Analysis of graduates' survey results from both the traditional and revised courses (Figures 6, 7 and 8 respectively), indicated that graduates of the revised course, on average, perceived a higher level of overall training fidelity than did graduates of the traditional course. In and of itself, this finding suggests that the revised course provided a greater perceived realism in training than the traditional course. If, as Gagne implies, such realism leads to more positive transfer of learned concepts from the school environment to the real world, then it appears that the revised course sequence was more effective on this dimension than the traditional course. To provide additional support for the effectiveness of the revised course on this dimension, future studies should collect data on course graduates regarding their success in recruiting (known as production per recruiter statistics), the demographic location of their recruiting facilities and their Recruiting District's style of management. It has been suggested that variables such as these may affect the return rate of graduates' questionnaires (Dyer et al., 1975). It is suggested here that these factors could also potentially affect graduates' perceptions of resident school training which, if left unaccounted for, could produce a misleading view of the perceived fidelity of the course.

4. Is there evidence of a change in the level of procedural fidelity regarding classroom instruction in the revised course over the duration of the study?

Analysis of course deviations and unscheduled audio-visual requests for each of the three evaluation cycles (Tables 3, 5 and 7 respectively) displayed a sharply declining trend throughout the study. The trend was found to be in the direction postulated in the standards for these transactions. This finding provides evidence to support the contention that the instructor staff gradually adapted their instructional processes to the revised course sequence. That the decline appeared to occur in concert with the changes initiated in the course sequence suggests a relationship. Whether or not such a relationship actually existed cannot be verified from the data collected. Nevertheless, the fact that sequence deviations did decline is important because the staff's committment to the revised sequence was originally an unknown factor having the potential to seriously impair the academic effectiveness of the course. Based on this finding, the investigator concluded that staff inertia against the revised course sequence was not a long-term problem, and therefore, is discounted as a potentially perturbing effect on the other findings of the study. Future evaluations of the course will, therefore, not have to contend with this potential problem unless another massive course revision is made.

5. Is there a difference in academic roll-back rates across several independent observations of the revised course?

Just as with attrition rates, the roll-back rates from the revised course displayed a strong decreasing trend. Both the roll-back rate and attrition rate decreased in concert with one another throughout the study (cf. Figure 9). The correlation between attrition rate and roll-back rate across all observation periods is approximately .30. This suggests only a slight interrelationship between the decline in the two rates. Thus, because both rates did decrease in a more or less parallel fashion, and because the decreases were not strongly dependent on one another, there is support for the contention that the revised course was effective in reducing both attrition rate and roll-back rate, independently.

Conclusion

This study has provided evidence that the ISM-developed (revised) course sequence was at least as effective as the Gagne-type (traditional) course sequence in reducing attrition and within-course failure rates, and in raising course graduates' perceptions of the fidelity of training received in school. These findings support the contention that ISM is a viable alternative methodology for developing reliable and easily manipulable instructional hierarchies and course sequences in the realm of competency-based instruction. Pending experimental findings in favor of the ISM methodology as applied to instructional hierarchy development, it appears that ISM possesses the potential to facilitate the hierarchy development process, and, to this extent, may assist in increasing the amount and quality of future research related to hierarchical learning.

Recommendations

Further research should be conducted to determine the efficacy of ISM methodology in developing instructional hierarchies and sequences. Such research should involve comparisons between an experimental course developed via ISM and a control version of the same course developed with the Gagne technique. Based on the research of Bloom and others, there appears to be a link between sequence and academic achievement. There is a need, therefore, to conduct research on ISM developed instructional sequences for non-competency-based courses, where achievement scores are more variable than in competency-based courses.

Because ISM is designed to resolve complexities in a system of interacting elements, it is interesting to speculate whether ISM is capable of resolving the complexities inherent in the structure of disciplines of knowledge. It is apparent, for example, that most disciplines are interrelated to one degree or another. However, the complexity of the whole issue of the structure of knowledge has hindered major attempts to quantify those interrelationships. Given that ISM possesses the capability of resolving complex systems into more simple arrangements of their constituent components, it is tempting to speculate on the possibility that, with the aid of ISM techniques, research could ensue in this area. At present, it is apparent to this investigator that such an undertaking would involve an interdisciplinary approach involving the best minds in each field of knowledge. Perhaps research such as this will reveal the findings necessary for development of a truly comprehensive theory of instruction.

Appendix A

AN APPLICATION OF GAGNE'S INSTRUCTIONAL SEQUENCING TECHNIQUE

Following is an illustrative application of Gagne's instructional sequencing technique as described by Briggs and Wager (1981). One of the 17 major topical areas in the Navy Enlisted Recruiting course, Sales Techniques, will serve as the content to be structured. This module contains eight objectives which are:

1. Perform a simulated sales interview in an office situation achieving a minimum of 75% accuracy based on the standard sales interview checklist.
2. Discuss aspects of generating and evaluating pre-approach blueprinting techniques and information.
3. Initiate and maintain conversation with an individual, and establish the individual's Dominant Buying Motive (DBM).
4. Arouse the individual's interest and curiosity based on his/her DBM.
5. Present the individual with specific Units of Conviction based on his/her DBM.
6. Demonstrate the procedures for handling the individual's objections during the interview.
7. Create desire in the individual by verbally painting a mental picture based on the five natural senses.
8. Close the sale using either the Weighing Close or Minor Decision Close.

The first step in the procedure is to identify competencies subordinate to each course objective. This procedure is accomplished by looking at a particular objective and asking "What would the learner have to be able to do or know before being able to perform this objective, given only instructions as to what to do on a test over the objective?" (Briggs and Wager, 1981, p. 90). After two or three general skill or knowledge components are identified for each objective, "these [components] are then examined, asking the same question, and each is reduced to increasingly simple skills and knowledges . . . [until the final identified component] can be performed as a single act."(p.90)

Via this procedure, those competencies identified as being subordinate to Objective #1 were Objectives #2 through #8. The competency identified by subject matter experts as being subordinate to Objectives #2 through #8 are indicated in Table 9.

The next step in the procedure was to determine the structural interrelationships among all objectives and competencies. Since there were a total of 28 objectives and competencies, 789 (28 x 28) pairs of relationships had to be considered. For the purpose of this illustration, consideration of this many relationships seemed excessive. In the interest of conciseness, the set of 28 elements was reduced to only the original eight objectives on the Sales Module. The excluded comptencies were implicitly subsumed under their respective objectives. This action is legitimate as long as the subject matter specialists recognize the presence of the appropriate competencies while they are considering the relationship between a pair of objectives. To this end, Table 9 was distributed to all subject matter experts during the hierarchy generation session.

Using the list of objectives identified earlier, each objective was selected, and the following question was asked

Table 9. Subordinate Competencies for Sales Module Objectives

---

Competencies under Objective 2:

- 2.1 Categories of blueprinting questions.
- 2.2 Sources of blueprinting information.
- 2.3 Recording blueprinting information.
- 2.4 Continue blueprinting to qualify individual and discover his/her wants & needs.

Competencies under Objective 3:

- 3.1 Establish rapport.
- 3.2 Question & summarize to establish Dominant Buying Motive (DBM).

Competencies under Objective 4:

- 4.1 Use verbal bridge.
- 4.2 State DBM claim.
- 4.3 Identify product.

Competencies under Objective 5/6:

- 5.1/6.1 Use verbal bridges.
- 5.2/6.2 Present Units of Conviction.
- 5.3/6.3 Provide evidence.
- 5.4/6.4 Watch and listen for subtle signals.
- 5.5/6.5 Trial close.

Competencies under Objective 7:

- 7.1 Remind prospect of problem.
- 7.2 Get prospect's confirmation.
- 7.3 Reinforce prospect's solution.
- 7.4 Project prospect to End Result using concrete language.

Competencies under Objective 8:

- 8.1 Weighing Close for procrastinator.
- 8.2 Close with minor decision.

---

relative to the other seven objectives in the set: "Would the learner have to know or do objective Y before being able to perform objective X?" Via this inquiry technique, the responses shown in Table 10 were generated. The inquiry process required approximately one anf one-half hours to complete.

To facilitate determination of the hierarchical structure of these objectives, according to Briggs and Wager (1981, p.90), it is important to identify the category of each objective - problem solving skills, rules, concepts or discrimination skills. These categories relate to the Sales Module objectives as listed in Table 11. Briggs and Wager (1981, p.90) have stated that "complete and empirically tested hierarchies for intellectual skills objectives appear to illustrate (1) problem solving skills require the use of two or more rules; (2) rule-using skills require the use of two or more concepts; and (3) concept behaviors require two or more discriminations." Using these guidelines,the relationships in Tables 10 and the classification of objectives in Table 11, the hierarchy of Figure 10 was produced.

Several departures from Briggs' and Wager's (1981) rules are apparent in the figure (indicated by asterisks in the figure). These represent inverted connections (e.g. rules and concepts lead to discriminations rather than vice versa). There is no apparent explanation for these departures. The solution to them, though, is apparent. The entire process is repeated until the resultant hierarchy is in a form acceptable to the subject matter specialists, and as compliant with the construction rules as possible.

Table 10. Interrelationships Among Sales Module Objectives As Perceived by Resident Subject Matter Specialists

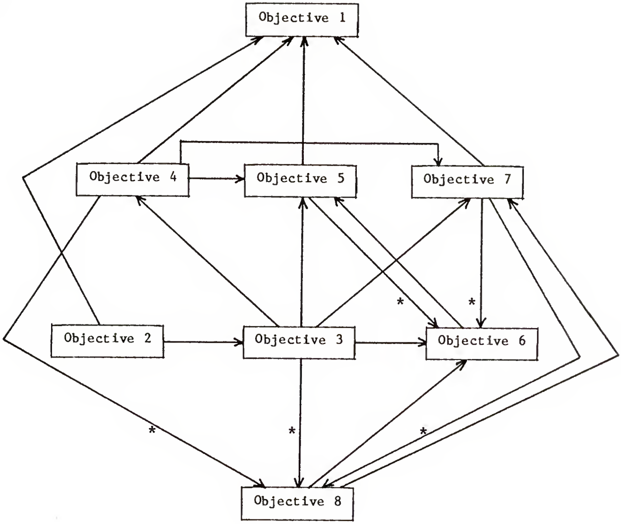
RELATIONSHIP	RESPONSE	RELATIONSHIP	RESPONSE
1 -> 2	NO	5 -> 1	YES
1 -> 3	NO	5 -> 2	NO
1 -> 4	NO	5 -> 3	NO
1 -> 5	NO	5 -> 4	NO
1 -> 6	NO	5 -> 6	YES
1 -> 7	NO	5 -> 7	NO
1 -> 8	NO	5 -> 8	NO
2 -> 1	YES	6 -> 1	YES
2 -> 3	YES	6 -> 2	NO
2 -> 4	NO	6 -> 3	NO
2 -> 5	NO	6 -> 4	NO
2 -> 6	NO	6 -> 5	YES
2 -> 7	NO	6 -> 7	NO
2 -> 8	NO	6 -> 8	NO
3 -> 1	YES	7 -> 1	YES
3 -> 2	NO	7 -> 2	NO
3 -> 4	YES	7 -> 3	NO
3 -> 5	YES	7 -> 4	NO
3 -> 6	YES	7 -> 5	NO
3 -> 7	YES	7 -> 6	YES
3 -> 8	YES	7 -> 8	YES
4 -> 1	YES	8 -> 1	YES
4 -> 2	NO	8 -> 2	NO
4 -> 3	NO	8 -> 3	NO
4 -> 5	YES	8 -> 4	NO
4 -> 6	NO	8 -> 5	YES
4 -> 7	YES	8 -> 6	YES
4 -> 8	YES	8 -> 7	YES

Note: For ease in reading this table, the verbiage of the questions is symbolically represented as follows:

X -> Y = "Would the learner have to know or perform objective X before accomplishing objective Y?"

Table 11. Classification of Sales Module Objectives

Objective Number	Classification
1	Problem Solving
2	Concept
3	Concept
4	Rule
5	Rule
6	Concept
7	Rule
8	Discrimination



NOTE: Asterisks on certain vectors in the hierarchy indicate departures from the interconnection rules established by Gagne, as enumerated by Briggs and Wager (1981).

Figure 10. A Learning Hierarchy for the Sales Module of the Navy Enlisted Recruiter Course

The process was repeated with the subject matter specialists. In reviewing their initial responses (cf. Table 10), they indicated unanimously that there were no changes to be made. The next step, then, was to examine the hierarchy and adjust it to reduce as many erroneous connections as possible. (Note: these erroneous connections are indicated in Figure 10 with asterisks.) In making this adjustment, all bi-directionally connected objectives were placed on the same level of the hierarchy. The adjustments were examined by the subject matter specialists after they were accomplished to determine if any discrepancies remained. The specialists indicated after this adjustment process that the hierarchy appeared to be more closely represent the theoretical interconnection of content than in the previous hierarchy. Thus, the process was terminated. The resulting hierarchy is shown in Figure 11. The entire process from beginning to end took approximately 3 hours. This hierarchy is extremely similar in form to that developed with the aid of the Interpretive Structural Modeling methodology (cf. Figure 14, Appendix B).

Although it is not evident from this simple illustration, such a trial-and-error process is both mentally taxing and time-consuming. The labor-intensiveness of this hierarchy construction process is in direct proportion to the number of objectives under consideration.

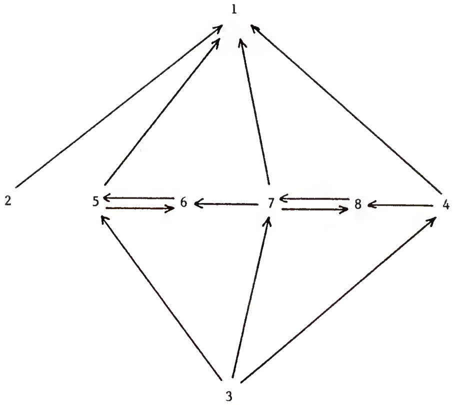


Figure 11. An Adjusted Gagne-type Hierarchy for the Sales Module

Appendix B

AN APPLICATION OF INTERPRETIVE STRUCTURAL MODELING TO INSTRUCTIONAL SEQUENCING

This appendix illustrates how the Interpretive Structural Modeling (ISM) methodology was applied to the task of constructing an instructional hierarchy. In order to compare the ISM methodology with Gagne's procedure, the Sales Module of the Navy Enlisted Recruiter Course, the same course segment used in Appendix 1, will also be used here.

Renckly's (1981) five-step process for applying ISM to the hierarchy construction problem is restated below:

> 1. Identify objectives of the curriculum.
> 2. Determine a transitive relation that applies to the objectives in the context of the instructional situation.
> 3. Place the objective relationships into a matrix format . . .
> 4. Manipulate the matrix into a suitable form - called a reachability matrix.
> 5. Re-order the rows and columns of the reachability matrix and partition it to reflect hierarchical levels . . . p. 203

This procedure was programmed into an APPLE II Plus microcomputer Although the manipulative process performed by the program is ordinarily transparent to the user, it will be explained in detail for the sake of illustration.

Step 1

The objectives identified for hierarchical ordering are identical to those stated in Appendix A. They are enumerated again as follows:

1. Perform a simulated sales interview in an office situation achieving a minimum of 75% accuracy based on the standard sales interview checklist.

2. Discuss aspects of generating and evaluating pre-approach blueprinting techniques and information.

3. Initiate and maintain conversation with an individual, and establish the individual's Dominant Buying Motive (DBM).

4. Arouse the individual's interest and curiosity based on his/her DBM.

5. Present the individual with specific Units of Conviction based on his/her DBM.

6. Demonstrate the procedures for handling the individual's objections during the interview.

7. Create desire in the individual by verbally painting a mental picture based on the five natural senses.

8. Close the sale using either the Weighing Close or Minor Decision Close.

Step 2

The transitive relation is necessary to comprehend or accomplish was agreed upon by the subject matter specialists involved in this hierarchy generation process. This relation was comparable in meaning to the question used to structure the Sales Module objectives via the Gagne procedure (cf. Appendix 1). This relation was combined with each pair of objectives to form a question, which is generically stated as follows:

> "Is Objective X necessary to comprehend
> or accomplish Objective Y?"

Step 3

Since there were eight objectives in the set, the subject matter specialists provided answers for 64 (8 x 8) distinct questions. For each question answered yes, the computer placed a 1 into the corresponding X-Y cell of a 8x8 matrix. Likewise, for each question answered no, the computer placed a 0 into the corresponding cell of the matrix. The completed matrix required approximately 30 minutes to construct, and is illustrated in Figure 12(a).

The matrix of Figure 12(a) is known as an adjacency matrix because it contains information (1s) on those objectives that are adjacent (i.e. directly connected) to one another in the hierarchical structure. However, there is insufficient information in this matrix to determine the form of the hierarchy (i.e. the number of levels in the hierarchy, the objectives within each level, etc.).

By definition, a Warfield (1976) defines a hierarchy as a multi-level structure, while Gagne (1977) describes such a structure as being composed of pair-wise relationships between objectives which are either dependent, supportive or independent. If an objective is determined to be dependent in relation to another objective, the two must necessarily lie on different levels of the hierarchy. Similarly, a pair of objectives bound in a mutually supportive relationship must, by necessity, lie on the same level of the hierarchy. Finally, objectives which are independent of all others in the set may or may not lie on the

$$\begin{array}{c|cccccccc|}
 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\
\hline
1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
2 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
3 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\
4 & 1 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
5 & 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
6 & 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
7 & 1 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\
8 & 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
\hline
\end{array} \qquad \text{(a)}$$

$$\begin{array}{c|cccccccc|}
\hline
1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
2 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
3 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\
4 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
5 & 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
6 & 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
7 & 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
8 & 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\
\hline
\end{array} \qquad \text{(b)}$$

$$\begin{array}{c|cccccccc|}
\hline
1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
2 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
3 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\
4 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
5 & 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
6 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
7 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
8 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
\hline
\end{array} \qquad \text{(c)}$$

$$\begin{array}{c|cccccccc|}
\hline
1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
2 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
3 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\
4 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
5 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
6 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
7 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
8 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\
\hline
\end{array} \qquad \text{(d)}$$

Figure 12. Three Iterations in the Matrix Multiplication Process (a) the original adjacency matrix, (b) the first iteration, (c) the second iteration and (d) the final reachability matrix for the Sales Module objectives.

same level as some other objective, but, in either event, the independent objective is not interconnected with any other in the hierarchy.

Step 4

In this step, the adjacency matrix is multiplied by itself (raised to powers) via binary multiplication. Each multiplication will change some of the originally supplied 0s in the matrix to 1s. Originally supplied 1s are not affected. Eventually, the multiplication process will reach a convergence point, wherein further multiplications will no longer change 0s to 1s. When convergence is achieved, the resulting matrix is referred to as the reachability matrix. This matrix contains information on the interconnections between objectives (from the adjacency matrix), as well as information detailing the number and composition of the levels within the hierarchy. Warfield (1976) has shown that the convergence point for any adjacency matrix can be achieved in N or fewer multiplications, where N is the number of objectives in the set. For the current illustration, the reachability matrix was obtained after three iterations. These three iterations are shown in Figure 12(b), (c) and (d).

Step 5

To extract information concerning the form of the hierarchy from the reachability matrix, the matrix is modified by row and column interchanges. This is efficiently accomplished by constructing partition tables. Table 12 provides an example of a such a partition table constructed from the reachability matrix of Figure 12(d).

Table 12. A Partition Table for the Matrix of Figure 12(d)

Objective Number	Reachability Set	Antecedent Set	Intersection Set
1	1	1, 2, 3, 4, 5, 6, 7, 8	1
2	1, 2, 3, 4, 5, 6, 7, 8	2	2
3	1, 3, 4, 5, 6, 7, 8	2, 3	3
4	1, 4, 5, 6, 7, 8	2, 3, 4, 5, 6, 7, 8	4, 5, 6, 7, 8
5	1, 4, 5, 6, 7, 8	2, 3, 4, 5, 6, 7, 8	4, 5, 6, 7, 8
6	1, 4, 5, 6, 7, 8	2, 3, 4, 5, 6, 7, 8	4, 5, 6, 7, 8
7	1, 4, 5, 6, 7, 8	2, 3, 4, 5, 6, 7, 8	4, 5, 6, 7, 8
8	1, 4, 5, 6, 7, 8	2, 3, 4, 5, 6, 7, 8	4, 5, 6, 7, 8

The table consists of three columns: a reachability set, an antecedent set and an intersection set. The reachability set for objective #1 is constructed by inspecting row #1 of the reachability matrix (Figure 12c). Every 1 in that row corresponds to a column index, and every such column index is in the reachability set of objective #1. The antecedent set for objective #1 is found by inspecting column #1 of the matrix. Every 1 in column #1 corresponds to a row index, and the set of such row indices comprises the antecedent set for objective #1. The intersection set of objective #1 is determined by finding the Boolean intersection of its reachability set and the antecedent sets. The intersection set contains all elements that simultaneously reside in both the reachability set and the antecedent set. In Figure 12(d), the row and column indices (1 - 8) identify the respective elements of the reachability, antecedent and intersection sets.

Once constructed, the table is examined to identify those objectives whose reachability set equals its intersection set. Such objectives are defined as members of the same level (i.e. they are mutually supportive) in the hierarchy. The reason for this is because every member of the intersection set must simultaneously be antecedent to, and reachable from, a given objective. For this to be true, the objective must lie on the same level as all others which meet these same conditions. Consider the following illustration:

Let <R> be a relation which binds a set of objectives (say A, B and C). Assume that objective B is in the reachability set of objective A (i.e., A <R> B). Assume, also, that objectives B and C are both members of the antecedent set of objective A (i.e., B <R> A and C <R> A). The intersection of these two sets is objective B, which satisfies the following relationships simultaneously:

A <R> B

B <R> A

Under these conditions, objectives A and B are symmetrically related. That is, they are in a supportive relationship with each other. Thus, they must both occupy the same level in the hierarchy. This argument easily extends to any number of objectives which meet the same conditions. From the table, it is clear that only objective #1 meets this condition. It, therefore, occupies the uppermost level in the hierarchy.

The top level of the hierarchy is now identified. All references to objective #1 in the table are removed, and a reduced (second-level) table is constructed (see Table 13). Again, the table is examined to identify those objectives for which the reachability and intersection sets match. Once found, these objectives compose the second level of the hierarchy. In this case, the second level is composed of objectives 4, 5, 6, 7 and 8. Again, all references to these objectives are removed from the table, and another reduced (third-level) table is constructed, as shown in Table 14. From this table, objective #3 is identified as

Table 13. A Reduced Partition Table - Level 1 Removed

Objective Number	Reachability Set	Antecedent Set	Intersection Set
2	2, 3, 4, 5, 6, 7, 8	2	2
3	3, 4, 5, 6, 7, 8	2, 3	3
4	4, 5, 6, 7, 8	2, 3, 4, 5, 6, 7, 8	4, 5, 6, 7, 8
5	4, 5, 6, 7, 8	2, 3, 4, 5, 6, 7, 8	4, 5, 6, 7, 8
6	4, 5, 6, 7, 8	2, 3, 4, 5, 6, 7, 8	4, 5, 6, 7, 8
7	4, 5, 6, 7, 8	2, 3, 4, 5, 6, 7, 8	4, 5, 6, 7, 8
8	4, 5, 6, 7, 8	2, 3, 4, 5, 6, 7, 8	4, 5, 6, 7, 8

Table 14. A Reduced Partition Table - Levels 1 and 2 Removed

Objective Number	Reachability Set	Antecedent Set	Intersection Set
2	2, 3	2	2
3	3	2, 3	3

occupying the third level of the hierarchy. Removing this objective from the table yields a fourth-level partition table. However, at this point, only objective #2 remains. Therefore, it is designated as occupying the fourth level of the hierarchy.

When the partition table is voided of all objectives, the partitioning process and the hierarchy are complete. The resultant ordered set is: (1; 4, 5, 6, 7, 8; 3; 2). This set provides the row and column interchange sequence for the reachability matrix. The modified matrix is shown in Figure 13. This matrix is useful in analyzing complex subsets of supporting objectives which are interconnected on the same level of the hierarchy, where three or more objectives are mutually interconnected.

The resultant hierarchy is constructed in three levels, each of which contain the objectives indicated in Figure 13. To determine the precise interconnections among objectives in the hierarchy, the adjacency matrix is consulted. The 1s in the adjacency matrix of Figure 12(a) indicate the interconnections. For example, a 1 in the (5,6) cell of the adjacency matrix indicates that objective 5 is connected to objective 6 (i.e. the arrowhead of the interconnecting vector points to objective 6). The completed hierarchy for the objectives of the Sales Module is displayed in Figure 14.

Once the hierarchy is produced, the subject matter specialists review it, asking the question: "In reality, is objective X connected to objective Y in the same manner as

	1	4	5	6	7	8	3	2	
1	1	0	0	0	0	0	0	0	- Level 1
4	1	1	1	1	1	1	0	0	- Level 2
5	1	1	1	1	1	1	0	0	
6	1	1	1	1	1	1	0	0	
7	1	1	1	1	1	1	0	0	
8	1	1	1	1	1	1	0	0	
3	1	1	1	1	1	1	1	0	- Level 3
2	1	1	1	1	1	1	1	1	- Level 4

Figure 13. A Modified Reachability Matrix Containing Four Levels

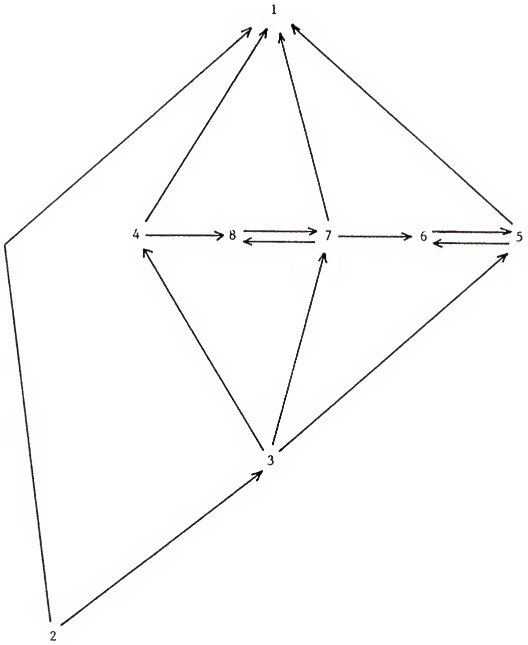


Figure 14. An ISM-Developed Hierarchical Structure for the Sales Module of the Enlisted Recruiter Course

depicted on the hierarchy?" The possibility exists that such an inquiry will reveal the hierarchy to be in error. If this is the case, Renckly's five-step procedure is reiterated. The primary advantage of the ISM technique over Gagne's methodology is that the subject matter specialists need only to re-manipulate those originally supplied data elements which were found to be in error on the hierarchy in order to recompute a revised hierarchy. The ISM algorithms handle the inferential ramifications of the subject matter specialists' changes. In Gagne's method, the subject matter specialists must explicitly reconsider most of the originally supplied data elements to determine the full extent of the intended hierarchy changes. The advantage offered by ISM alleviates the subject matter specialists from the necessity of investing an excessive amount of mental effort in protracted, repetitive hierarchy revision sessions. Thus, the labor-intensive nature of Gagne's method, which becomes clearly evident during the hierarchy revision process, is overcome by the use of ISM's inferential algorithmic procedure, and is made even more useful by the intervention of the computer.

Appendix C

POST GRADUATE SURVEY QUESTIONNAIRE

The following questions were used to gather information concerning course graduates' perceptions of how applicable their school training was to real-world recruiting practices.

1. How well did you understand the operation of the CNRC Chain of Command?
2. How well did you understand what you must do to become qualified in accordance with RQS?
3. How well did you understand RPPMS (Freeman Plan)?
4. How well could you blueprint?
5. How well could you establish rapport?
6. How well could you arouse curiosity?
7. How well could you provide conviction?
8. How well could you create desire?
9. How well could you close?
10. How well could you handle objections?
11. How well could you deliver speeches?
12. How well could you make appointments using the telephone?
13. How well could you obtain referral leads and make appointments with them?
14. How well could you handle responses?
15. How well could you use mass/personal mailouts?
16. How well could you personally develop contacts (face-to-face)?
17. How well could you complete a standard pre-enlistment kit?
18. How well could you complete a kit requiring a waiver?
19. How well could you complete a kit for a prior-service applicant?

20. How well could you complete a TAB F?

21. How well could you complete a TAB G?

22. How well could you complete a TAB H?

23. How well could you analyze a TAB A?

24. How well could you fill out a prospect card?

25. How well did you understand the purpose of the Prospect Card System?

26. How well did you understand the use of the Prospect files?

27. How well did you understand the use of the SMART System?

28. How well could you develop an itinerary from displayed SMART information?

29. How well did you understand the proper use and security requirements of the credit card along with it's limits?

30. How well did you understand the procedures for emergency vehicle repairs?

31. How well did you understand CNRC domicile-to-duty policy?

32. How well did you understand vehicle safety requirements?

33. How well did you understand the function of the Education Specialist?

34. How well did you understand the function of the Recruiting District Assistance Council?

35. How well did you understand the function of the Campus Liaison Officer?

36. How well did you understand the function of the Youth Programs Officer/Petty Officer?

Appendix D

RECRUITER CANVASSER JOB TASK INVENTORY

The following task inventory, excerpted from the United States Navy Recruiting Command Enlisted Recruiter Canvasser Course: Program of Instruction (1984), lists the elements comprising the job of the Enlisted Navy Recruiter. Items below without asterisks are designated as necessary to be trained at the resident school. Those with asterisks are NOT trained at the school.

1.0 ADMINISTRATION

1.1 Continuously employ all required security measures.

- 1.1.1 Identify security requirements for NRS.
- 1.1.2 Identify security requirements for test materials.
- 1.1.3 Identify security requirements for Government TRs, transportation and meal tickets.
- 1.1.4 Identify prospect information security requirements.
    - 1.1.4.1 Privacy Act
    - 1.1.4.2 Freedom of Information Act
- 1.1.5 Apply security measures.

* 1.2 Compile station logs and submit reports.

- * 1.2.1 Identify pertinent station logs/reports.
- * 1.2.2 Explain the purpose of logs and reports.
    - * 1.2.2.1 Motor vehicle reports
    - * 1.2.2.2 Bulk ticket logs
    - * 1.2.2.3 Out-of-pocket expense sheet
    - * 1.2.2.4 Motor vehicle logs
    - * 1.2.2.5 Individual evaluation input sheet
- * 1.2.3 Research procedures for compiling station logs and reports.
- * 1.2.4 Continuously maintain delegated station logs.
- * 1.2.5 Submit reports as required.

1.3 Use CNRC production chain of command.

- 1.3.1 Identify the CNRC production chain of command.
- * 1.3.2 Identify incumbents by name in the CNRC production chain of command.

1.3.3 Explain the use of the chain of command.
    1.3.3.1 Information flow
    1.3.3.2 Individual requests
    1.3.3.3 Point papers
    1.3.3.4 Order passing

* 1.4 Follow directives of higher authority.

* 1.5 Become qualified in accordance with Recruiter Qualification Standards (RQS).

1.5.1 Describe the purpose and minimum standards for qualification under RQS.
1.5.2 Describe the operation of the Recruiter Personnel Production Management System.

2.0 MARKETING

2.1 Identify target market populations.

2.1.1 Identify assigned territory boundaries.
2.1.2 Identify educational institutions.
    2.1.2.1 High schools
    2.1.2.2 Colleges
    2.1.2.3 Community Colleges
    2.1.2.4 Vocational/Technical schools
    2.1.2.5 Quality of educational institutions
2.1.3 Identify population centers.
    2.1.3.1 Metropolitan areas
    2.1.3.2 Cities
    2.1.3.3 Towns
    2.1.3.4 Unincorporated areas
2.1.4 Identify leisure-time activity centers.
    2.1.4.1 Youth centers
    2.1.4.2 Pool halls
    2.1.4.3 Athletic leagues
    2.1.4.4 Restaurants
    2.1.4.5 Automotive centers
* 2.1.5 Provide information on assigned territory.

2.2 Use Navy Recruiting District (NRD) resources.

2.2.1 Identify recruiter support functions of each department.
    2.2.1.1 Officer Prograns
    2.2.1.2 Enlisted Programs
    2.2.1.3 Processing
    2.2.1.4 Classification
    2.2.1.5 Recruiting Aids
    2.2.1.6 Public Affairs
    2.2.1.7 Supply
    2.2.1.8 Administrative

- 2.2.1.9 Education Specialist
- 2.2.1.10 Lead Tracking Center

* 2.2.2 Use and maintain allocated equipment.
  - * 2.2.2.1 Identify equipment.
    - * 2.2.2.1.1 Fairchild projector
    - * 2.2.2.1.2 35MM Slide projector
    - * 2.2.2.1.3 16MM Motion picture projector
    - * 2.2.2.1.4 Codaphone
    - * 2.2.2.1.5 Typewriter
    - * 2.2.2.1.6 Polaroid camera
  - * 2.2.2.2 Operate equipment.
  - * 2.2.2.3 Conduct routine maintenance.
  - * 2.2.2.4 Perform minor repairs.
  - * 2.2.2.5 Describe equipment replacement procedures.

2.3 Use community personnel resources to contribute to the recruiting effort.

- 2.3.1 Identify community personnel who could assist in the recruiting effort.
  - 2.3.1.1 Local education personnel
  - 2.3.1.2 Labor personnel
  - 2.3.1.3 Government personnel
  - 2.3.1.4 Reserve activities personnel
  - 2.3.1.5 Recruiting Assistance Program personnel
  - 2.3.1.6 Hometown Assistance Recruiting Program personnel
  - 2.3.1.7 Delay Entry Program personnel
  - 2.3.1.8 Other Navy enlistees
  - 2.3.1.9 Military retired personnel
  - 2.3.1.10 Naval Academy Liaison personnel
  - 2.3.1.11 Recruiting District Assistance Council personnel
  - 2.3.1.12 Local media personnel
  - 2.3.1.13 Civic organizations
  - 2.3.1.14 Youth organizations
  - 2.3.1.15 Professional organizations
  - 2.3.1.16 Veterans' organizations
  - 2.3.1.17 Veterans' counselors
  - 2.3.1.18 Parents of enlistees
  - 2.3.1.19 Minority organizations
  - 2.3.1.20 Local business owners/managers
- 2.3.2 Identify how they may assist.
- 2.3.3 Convince community personnel to contribute to the recruiting effort.
  - 2.3.3.1 Use sales skills.
- 2.3.4 Request specific assistance and follow-up.
- 2.3.5 Recognize effective assistance.

3.0 PROSPECTING

3.1 Operate Government vehicles in accordance with current directives.

- * 3.1.1 Possess a Government driver's license.
- 3.1.2 Successfully complete a defensive driving course.
- 3.1.3 Describe vehicle operating instructions.
- 3.1.4 Describe all safety instructions.
- 3.1.5 Describe instructions for use of credit cards.
  - 3.1.5.1 Fuel procurement
  - 3.1.5.2 Minor repairs
  - 3.1.5.3 Limitations on use
  - 3.1.5.4 Replacement procedures
- * 3.1.6 Successfully complete a road test.

3.2 Use the prospect card system.

- 3.2.1 Obtain prospect names.
  - 3.2.1.1 School lists
  - 3.2.1.2 High school yearbook
  - 3.2.1.3 Newspaper articles
  - 3.2.1.4 Athletic rosters
  - 3.2.1.5 Purchased lists
- 3.2.2 Transcribe all prospect names to prospect cards.
- 3.2.3 Describe the prospect card filing system.
  - 3.2.3.2 Working file
  - 3.2.3.3 School file
  - 3.2.3.4 College file
  - 3.2.3.5 Direct file
  - 3.2.3.6 Prior-service file
- 3.2.4 Continuously update prospect information.
- 3.2.5 Obtain and return prospect cards to Recruiter-in-Charge.

3.3 Make appointments by developing contacts.

- 3.3.1 Make appointments by telephone.
  - 3.3.1.1 Use a telephone technique.
  - 3.3.1.2 Document information.
  - 3.3.1.3 Record appointment on calendar.
  - 3.3.1.4 Document activity.
- 3.3.2 Make appointments via personal contacts.
  - 3.3.2.1 Initiate face-to-face contact.
  - 3.3.2.2 Ask for appointment.
  - 3.3.2.3 Document information.
  - 3.3.2.4 Record appointment on calendar.
  - 3.3.2.5 Document activity.

- 3.3.3 Make appointments with referrals.
    - 3.3.3.1 Ask for referrals.
    - 3.3.3.2 Initiate contact.
    - 3.3.3.3 Ask for appointment.
    - 3.3.3.4 Document information.
    - 3.3.3.5 Record appointment on calendar.
    - 3.3.3.6 Document activity.
- 3.3.4 Use mail-outs.
    - 3.3.4.1 Coordinate mass mail-outs.
    - 3.3.4.2 Use personalized mail-outs.
    - 3.3.4.3 Handle responses.
    - 3.3.4.4 Document information.
    - 3.3.4.5 Document activity.
- 3.3.5 Make appointments with advertising leads.
    - 3.3.5.1 Pursue all advertising leads.
    - 3.3.5.2 Ask for appointment.
    - 3.3.5.3 Document information.
    - 3.3.5.4 Record appointment on calendar.
    - 3.3.5.5 Document activity.
    - 3.3.5.6 Provide feedback on lead to District Lead Tracking Center.

3.4 Develop a prospecting plan.

- * 3.4.1 Obtain minimum recruiting goals from supervisor.
- 3.4.2 List all available resources.
- 3.4.3 List uses of each resource.
- 3.4.4 Determine required prospecting activity levels.
    - 3.4.4.1 Telephone
    - 3.4.4.2 Referrals
    - 3.4.4.3 Personally developed contacts
    - 3.4.4.4 Mail-outs
    - 3.4.4.5 Advertising
- 3.4.5 Develop itineraries using the SMART system as a resource.
- 3.4.6 Use planning calendars.
- 3.4.7 Schedule all activity within specific time frames.
- 3.4.8 Submit to supervisor for approval.

* 3.5 Implement approved prospecting plan.

3.6 Improve existing prospecting plan.

- 3.6.1 Analyze results.
- 3.6.2 Analyze activity.
- 3.6.3 Adjust activity.
- 3.6.4 Draft new plan.
- 3.6.5 Obtain approval.

4.0 SELLING

4.1 Use sales skills.

- 4.1.1 Generate and evaluate pre-approach blueprint information.
  - 4.1.1.1 Categories of blueprinting questions
  - 4.1.1.2 Sources of blueprinting information
  - 4.1.1.3 Recording blueprinting information
  - 4.1.1.4 Continue blueprinting to qualify and discover wants and needs of prospect.
- 4.1.2 Initiate and maintain conversation.
  - 4.1.2.1 Establish rapport.
  - 4.1.2.2 Question and summarize to establish Dominant Buying Motive (DBM).
- 4.1.3 Arouse curiosity/interest.
  - 4.1.3.1 Use verbal bridges.
  - 4.1.3.2 State DBM claim.
  - 4.1.3.3 Identify product.
- 4.1.4 Provide conviction.
  - 4.1.4.1 Use verbal bridges.
  - 4.1.4.2 Present unit of conviction.
  - 4.1.4.3 Provide evidence.
  - 4.1.4.4 Watch and listen for subtle signals.
  - 4.1.4.5 Trial close
  - 4.1.4.6 Handle objections.
- 4.1.5 Create desire.
  - 4.1.5.1 Remind prospect of problem.
  - 4.1.5.2 Get prospect's confirmation.
  - 4.1.5.3 Reinforce proposed solution.
  - 4.1.5.4 Project prospect to end result using concrete language.
- 4.1.6 Close the sale.
  - 4.1.6.1 Weighing close for procrastinator
  - 4.1.6.2 Close with minor decision.

4.2 Conduct Interviews.

- 4.2.1 Plan approach.
  - 4.2.1.1 Review prospect's documented data.
- 4.2.2 Incorporate sales skills in presentation.
  - 4.2.2.1 Tailor presentation to wants and needs of interviewee.
  - 4.2.2.2 Practice law of psychological reciprocity throughout interview.
  - 4.2.2.3 Do not challenge beliefs.
  - 4.2.2.4 Forget self completely.
  - 4.2.2.5 Maintain control of conversation.
- 4.2.3 Analyze results.

4.3 Qualify potential enlistees.

- 4.3.1 Basic Enlistment Eligibility Requirements
- 4.3.2 Waivers
- 4.3.3 Prior-service

4.4 Present Navy image to community.

- 4.4.1 Deliver speeches.
  - 4.4.1.1 Promote awareness.
- 4.4.2 Maintain community relations.
  - 4.4.2.1 Personal appearance
  - 4.4.2.2 Personal conduct
  - 4.4.2.3 Involvement in community affairs

4.5 Document activity.

- 4.5.1 Activity Analysis System
- 4.5.2 Prospect card system
- 4.5.3 National/local Lead Tracking System

5.0 PROCESSING

5.1 Prepare pre-enlistment kits.

- 5.1.1 Complete a standard pre-enlistment kit.
- 5.1.2 Complete a pre-enlistment kit requiring a waiver.
- 5.1.3 Complete a prior-service pre-enlistment kit.

* 5.2 Provide assistance to further process the applicant.

- * 5.2.1 Schedule applicant.
  - * 5.2.1.1 MET site
  - * 5.2.1.2 MEPS
  - * 5.2.1.3 NRD
- * 5.2.2 Provide transportation.
- * 5.2.3 Brief applicant on scheduled procedures.

5.3 Follow guidelines in established recruiting directives.

5.4 Handle returned applicants.

- 5.4.1 Indoctrinate DEP personnel on responsibilities.
- 5.4.2 Pursue Qualified-Not-Enlisted applicants.
- 5.4.3 Counsel permanently rejected applicants.

- 5.4.3.1 Determine if applicant harbors ill will toward Navy because of rejection.
- 5.4.3.2 Demonstrate empathy for his/her situation.
- 5.4.3.3 Attempt to neutralize his/her negative attitude toward the Navy.

5.4.4 Counsel temporarily rejected applicants.

- 5.4.4.1 Determine if applicant harbors ill will toward Navy because of rejection.
- 5.4.4.2 Demonstrate empathy toward his/her situation.
- 5.4.4.3 Inform applicant what he/she must do to become enlistment eligible.

5.5 Improve processing results

- 5.5.1 Document activity.
  - 5.5.1.1 TAB H
  - 5.5.1.2 Prospect cards
- 5.5.2 Analyze results.
  - 5.5.2.1 Accessions
- 5.5.3 Analyze activity.
  - 5.5.3.1 Interviews
  - 5.5.3.2 ASVABs
  - 5.5.3.3 Physicals
  - 5.5.3.4 Screen tests
- 5.5.4 Adjust activity.

Appendix E

RECRUITER CANVASSER COURSE OBJECTIVES

The following list of course objectives was excerpted from the United States Navy Recruiting Command Enlisted Recruiter Canvasser Course: Program of Instruction (1984). Note that decimal numbers indicate sub-objectives for each main objective.

1.0 Explain applicable security requirements using CNRC security directives.

  1.1 Explain NRS security requirements.

  1.2 Explain test material security requirements.

  1.3 Explain security requirements for Government TRs, bulk transportation and meal tickets.

  1.4 Explain security requirements concerning prospects' personal information.

2.0 Discuss the relationships among the Recruiter Qualification Standards (RQS), the Freeman Plan and recruiter incentives.

  2.1 Describe the purpose and minimum standards for qualification under RQS.

  2.2 Describe the purpose, operation of, and benefits derived from the Freeman Plan.

  2.3 Identify various recruiter incentives.

3.0 Diagram the CNRC production chain of command.

  3.1 Identify the CNRC production chain of command.

  3.2 Using the CNRC production chain of command, explain how information is transmitted and/or received.

4.0 Interpret the information displayed on a SMART Board.

  4.1 Identify assigned territory boundaries.

  4.2 Identify types of educational institutions.

4.3 Identify population centers.

4.4 Identify leisure-time activity centers.

4.5 Explain the purpose of specific information on the SMART Board.

4.6 Discuss the value of the SMART Board in developing marketing strategies.

5.0 Describe the functions of all departments within the NRD.

5.1 Identify all departments within the NRD.

5.2 Explain the recruiter support functions of each department.

6.0 Explain how community personnel can contribute to the recruiting effort.

6.1 Identify those personnel who are in a position to contribute to the recruiting effort.

6.2 Describe methods for presenting awards and letters of appreciation to personnel who contribute to the recruiting effort.

7.0 Using applicable CNRC directives, describe the purpose and function of the prospect card system.

7.1 List the sources from which names of prospects can be obtained.

7.2 Describe what specific information must be transcribed onto the prospect card.

7.3 Explain the purpose of each card in relation to its placement in the various files of the system.

7.4 Explain how the prospect card system operates.

7.5 Given specific information on a prospect, complete a prospect card.

7.6 Given a partially completed prospect card, update it with additional information.

7.7 Explain the procedures for maintaining the prospect card system.

    7.8 Explain the procedures for purging the prospect card system.

    7.9 Explain the procedures for updating the prospect card system.

8.0 Given hypothetical prospecting information, develop a prospecting plan which includes all prospecting categories.

    8.1 Document prospecting and processing activities on applicable forms.

    8.2 Identify resources used to develop a prospecting plan.

    8.3 Describe how the listed resources can be used to your advantage.

    8.4 Given hypothetical prospecting information and monthly goals, compute success ratios for each prospecting activity necessary to accomplish the goals.

    8.5 Compile prospecting activity levels necessary to accomplish the goals.

    8.6 Given a map of a recruiting territory and pertinent information, develop a travel itinerary.

    8.7 Using computed prospecting information, schedule prospecting activity within specific time frames on a daily planner.

    8.8 Explain the procedures for implementing the prospecting plan.

    8.9 Analyze an existing prospecting plan, determine its inadequacies and describe how the plan could be improved.

9.0 Make appointments using the methods of each prospecting category.

    9.1 Describe all prospecting categories without error.

    9.2 Given an approved telephone prospecting script and a list of prospects' names and phone numbers, make appointments and seek referrals using a telephone.

    9.3 Given an approved prospecting script, describe appointment power using the personally developed contact (PDC) method.

9.4 Make appointments using pertinent referral information and an approved prospecting script.

9.5 Discuss the advantages and disadvantages of prospecting with mail-outs.

9.6 Describe what advertising methods would be most effective for obtaining appointments.

9.7 Explain how the Local Effective Accessions Delivery System (LEADS) can reduce the recruiter's prospecting activity time.

10.0 Perform a simulated sales interview in an office situation, achieving 75% accuracy based on the standard sales interview checklist.

10.1 Discuss aspects of generating and evaluating pre-approach blueprinting techniques and information.

10.2 Initiate and maintain conversation with an individual, and establish the individual's Dominant Buying Motive (DBM).

10.3 Arouse the individual's interest and curiosity based on his/her DBM.

10.4 Present the individual with specific Units of Conviction based on his/her DBM.

10.5 Demonstrate the procedures for handling the individual's objections during the interview.

10.6 Create desire in the individual by verbally painting a mental picture based on the five natural senses.

10.7 Close the sale using either the Weighing Close or Minor Decision Close.

11.0 Determine an individual's qualifications for enlistment.

11.1 Identify Basic Enlistment Eligibility Requirements.

11.2 Explain under what circumstances a waiver is required.

11.3 Identify requirements and options available to prior-service individuals seeking re-enlistment.

12.0 In a simulated community event, present a proper Navy image in accordance with CNRC and U.S. Navy directives.

  12.1 Deliver Navy awareness speeches.

  12.2 Present a proper Navy image at all times.

13.0 Using hypothetical applicant information, complete pre-enlistment kits by printing legibly in black/blue-black ink. All kit errors must be corrected by the student until the kit is error-free.

  13.1 Complete a standard pre-enlistment kit.

  13.2 Complete a pre-enlistment kit requiring a waiver.

  13.3 Complete a pre-enlistment kit for a prior-service applicant.

  13.4 Quality control a pre-enlistment kit.

14.0 Using CNRC and MEPCOM directives, explain how an applicant is scheduled and processed through the Military Enlistment Processing Station (MEPS).

  14.1 Describe the physical testing procedures at MEPS.

  14.2 Describe various physical profiles and their significance.

  14.3 Describe mental testing procedures at MEPS.

15.0 Using and complying with applicable directives, notices and instructions, demonstrate the ability to use the Recruiting Manual and the RETOPS-ENL manual as reference tools.

  15.1 Maintain/update the Recruiting Manual and RETOPS-ENL Manual without error.

  15.2 Demonstrate proficiency in using the Recruiting Manual as a reference tool for enlistment/re-enlistment purposes.

  15.3 Demonstrate proficiency in using the RETOPS-ENL Manual as a reference tool.

16.0 Explain how to instruct and counsel applicants.

  16.1 Describe DEP responsibilities.

16.2 Explain how to pursue qualified-not-enlisted (QNE) applicants.

16.3 Describe how to counsel permanently rejected applicants.

17.0 Using required forms and documents, analyze and adjust processing results from interviews to accessions.

17.1 Analyze the results of previously documented processing activities.

17.2 Explain the procedures for adjusting processing activity to improve results.

Appendix F

CORRESPONDENCE BETWEEN JOB TASKS AND COURSE OBJECTIVES

The following correspondence listing was excerpted from the United States Navy Recruiting Command Enlisted Recruiter Canvasser Course: Program of Instruction (1984).

OBJECTIVE NUMBER	RELATED TASK(S)
1.1	1.1.1
1.2	1.1.2
1.3	1.1.3
1.4	1.1.4
2.1	1.5.1
2.2	1.5.2
2.3	1.5.3
3.1	1.3.1
3.2	1.3.3
4.1	2.1.1
4.2	2.1.2
4.3	2.1.3
4.4	2.1.4
4.5	3.4.5
4.6	3.4.5
5.1	2.2.1
5.2	2.2.1
6.1	2.3.1
6.2	2.3.2, 2.3.3
7.1	3.2.1
7.2	3.2.2
7.3	3.2.3
7.4	3.2.3, 3.2.4, 3.2.5
7.5	3.2.2
7.6	3.2.4
7.7	3.2.2, 3.2.4, 3.2.5
7.8	3.2.4, 3.2.5
7.9	3.2.4, 3.2.5

OBJECTIVE NUMBER	RELATED TASK(S)
8.1	3.3.1.4, 3.3.2.5, 3.3.3.6, 3.3.4.5, 3.3.5.6, 4.5.1, 4.5.2
8.2	3.4.2
8.3	3.4.3
8.4	3.4.4
8.5	3.4.4
8.6	3.4.5
8.7	3.4.6, 3.4.7
8.8	3.4.8, 3.5
8.9	3.6.1, 3.6.2, 3.6.3, 3.6.4
9.2	3.3.1
9.3	3.3.2
9.4	3.3.3
9.5	3.3.4
9.6	3.3.5
9.7	3.3.5, 4.5.3
10.1	4.4.1, 4.2.1
10.2	4.1.2, 4.2.2
10.3	4.1.3, 4.2.2
10.4	4.1.4, 4.2.2
10.5	4.1.4, 4.2.2
10.6	4.1.5, 4.2.2
10.7	4.1.6, 4.2.2
11.1	4.3.1
11.2	4.3.2
11.3	4.3.3
12.1	4.4.1
12.2	4.4.2
13.1	5.1.1
13.2	5.1.2
13.3	5.1.3
13.4	5.1.1.1, 5.1.2.1, 5.1.3.1
14.1	5.2.3
14.2	5.2.3, 5.3
14.3	5.2.3

OBJECTIVE NUMBER	RELATED TASK(S)
15.1	5.3
15.2	5.3
15.3	5.3
16.1	5.4.1
16.2	5.4.2
16.3	5.4.3, 5.4.4
17.1	5.5.1, 5.5.2, 5.5.3
17.2	5.5.4

Appendix G

COMPUTATION OF GRADUATE SURVEY SAMPLE SIZE

This appendix describes the method used to estimate the sample size of graduates' surveys needed to determine, within a 95% confidence level, whether a clear majority of a group of students advocated a change to the instructional process. The average class size (group) in the study was approximately 30 students. Each group was assumed to exhibit a normally distributed population variance in terms of its perceptions of course adequacy. By invoking the central limit theorem, the binomial distribution of the small group size was replaced with an approximation to a normal distribution.

The criteria established by the school to define "a clear majority of graduates" was any percentage greater than or equal to 50% of a graduating class. Given this, a one-tailed confidence interval was constructed around a cutoff value of 0.5.

The notation below applies to the following computations:

P = proportion of graduates recommending a change.

C = cutoff value to determine a clear majority (0.5).

N = group size.

R = return rate expected (0.2)

n = sample size of returned questionnaires.

α = confidence level (.95).

z = normal deviate for a given confidence level.

Q = 1-P.

n' = sample size of questionnaires to be sent out.

The formula for the confidence limits of a binomial parameter estimate is:

$$p \pm z_{(1-\alpha)}\sqrt{PQ/n}\,.$$

Since the confidence interval is one-sided, the limit becomes:

$$p - z_{2(1-\alpha)}\sqrt{PQ/n} \geqslant C.$$

Adding the discrete binomial correction factor and the finite population correction factor yields:

$$p - (z_{2(1-\alpha)}\sqrt{PQ/n}\ \sqrt{1-n/N} + 1/2n) \geqslant C$$

or

$$p - (z_{2(1-\alpha)}\sqrt{PQ/n - PQ/N} + 1/2n) \geqslant C.$$

Since alpha = .95 and C = .5, we have:

$$p - (1.645\sqrt{PQ/n - PQ/N} + 1/2n) \geqslant 0.5$$

For this study, the expected proportion recommending a change to the curriculum (p) was established by the school's administration as 0.8. Thus, Q (=1-P) equals 0.2. Group size (N) was 30. Entering these into the formula yields:

$$0.8 - (1.645\sqrt{.16/n - .16/30} + 1/2n) \geqslant 0.5$$

$$0.3 - 1/2n \geqslant 1.645\sqrt{.16/n - .16/30}$$

$$0.3n/1.645 - 0.5/1.645 \geqslant \sqrt{.16n - .0053n^2}$$

$$(.1824n - .3040)^2 \geqslant .16n - .0053n^2$$

$$.0333n^2 - .1109n + .0924 \geqslant .16n - .0053n^2$$

$$.0386n^2 - .2709n + .0924 \geqslant 0.$$

Using the quadratic formula to solve for n yields:

$$n \geqslant (.2709 \pm \sqrt{.0734 - .0143})/.0772$$

$$\geqslant 3.5091 \pm 3.1490.$$

Thus,

$$n \geqslant 0.3601 \text{ or } n \geqslant 6.6581.$$

By selecting the greater value, it can be seen that at least 7 questionnaires (6.6581 rounded up) must be returned to assure a majority recommendation with 95% confidence. The final step is to determine how many surveys to send out (n') to course graduates to ensure an expected return rate of 7 questionnaires per group. Since the estimated return rate is 0.2, we have:

$$n' = n/R = 6.6851/0.2$$

$$n' = 33.2905.$$

Since n'>N, surveys were sent to each graduate of every class in the study.

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BIOGRAPHICAL SKETCH

Thomas Robert Renckly was born in McKeesport, Pennsylvania, on March 15, 1948. Upon his graduation from Pennsylvania State University in June 1970, where he received a Bachelor of Science degree in physics, he entered the United States Air Force. After receiving an honorable discharge in 1974, Mr. Renckly entered Civil Service as an instructor in aerodynamics and flight control systems at Chanute Air Force Base, Illinois. During this time, he received a Master of Science degree in Education (instructional media) from Eastern Illinois University. Mr. Renckly then accepted a position with the United States Navy Recruiting Command as the Curriculum Coordinator for the Navy Recruiting Command's training facility in Orlando, Florida. Following this, Mr. Renckly accepted his current position as Curriculum Coordinator for the United States Air Force's Air University system, headquartered in Montgomery, Alabama.

During his fourteen years in the military educational arena, Mr. Renckly has authored and copyrighted several microcomputer programs designed to aid in instructional development and evaluation. One of his programs, CHASE, is designed to aid instructional designers in developing instructional hierarchies and sequences for course presentations. He has used this program to aid him in developing courses of instruction for the Navy Recruiting Command and for the University of Central Florida. One of the courses he developed for the Recruiting Command with the aid of CHASE served as the basis for his doctoral dissertation.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Education.

William D. Hedges

William D. Hedges, Chairman
Professor of Instructional
Leadership ans Support

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Education.

Forrest W. Parkay

Forest Parkay
Associate Professor of
Instructional Leadership and
Support

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Education.

Elroy J. Bolduc

Elroy J. Bolduc
Professor of Subject
Specialization Teacher Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Education.

John K Bengston

John Bengston
Associate Professor of
Foundations of Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Education.

Robert L. Lange

Robert L. Lange
Professor of Foundations of
Education

This dissertation was submitted to the Graduate Faculty of the Division of Curriculum and Instruction in the College of Education and to the Graduate School, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Education.

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Dean for Graduate Studies and
Research